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ABSTRACT

More than 50 outdoor activities and 60 follow-up activities for children in grades five and six are collected in this teacher's guide. They focus on the interdependence of life; the relationship of man, animals, and plants to each other and to the environment. Most are designed as field trips, utilizing a discovery and questioning approach to learning. Based on pilot activities conducted at the Southeastern Pennsylvania Outdoor Education Center, they were subsequently revised and adapted by the New Castle-Gunning Bedford Environmental Laboratory, an ESEA Title III project. A master key divides the major activities into categories: (1) seasonal activities, (2) flora, (3) fauna, (4) habitat studies, (5) weather, geology, soils, hydrography, and (6) awareness, man and nature. For each activity also checked are appropriate grade level(s), season(s) in which to conduct it, and coordinated follow-up activity(ies). A similar key is provided for follow-up activities indicating the major activity which it is associated with in place of the coordinated follcw-up activity. Each lesson outlines objectives, procedures and/or activities on the trip, and pertinent questions. Diagrams and charts supplement some of the information. (BL)

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ENVIRONMENTAL CURRICULUM MATERIALS

LEVEL III (5,6)

January, 1973

INCORPORATING
the outdoor classroom
"discovery" approach
spiral sequence activities
and follow-ups

SE015 818

These materials were developed and piloted over a period of years at the Southeastern Pennsylvania Outdoor Education Center, an E.S.E.A. Title III project administered by the Rose Tree Media School District, Lima, Pennsylvania from 1966-1971. The activities and follow-ups were written by teachers and consultants in workshops and institutes and were revised by members of the SPOEC staff and, in 1970-71, by Roger Daum, Coordinator of the New Castle-Gunning Bedford Environmental Laboratory, an E.S.E.A. Title III project.

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ACTIVITY MASTER KEY
LEVEL III

PAGE	TITLE
1	To the Teachers or Guide
3	The Interdependence of Life: The Relationship of Man, Animals, and Plants to each other and to the Environment
5	A Dozen Concepts....for Environmental Education

			Level K	1	2	3	4	5	6	Season	Follow-Up
Seasonal Activities											
Act#4	10	BIRDS IN AUTUMN----------						x	x	F	2,8,47,48
Act#5	11	SEED DISPERSAL: Field & Forest----------	x	x	x	x	x	x	x	F	21,22,59
Act#7	13	STORIES IN SNOW----------						x	x	W	4,6,8
Act#11	25	THE MARSH IN WINTER--------						x	x	W	7
Act#16	36	TREE BUDS----------					x	x	x	Sp	3,9
Act#18	40	MAYAPPLE, JACK-IN-THE-PULPIT----------						x	x	Sp	19
Act#19	42	FLOWERS----------			x	x	x	x	x	Sp	10,11
Act#20	44	FLOWERS----------						x	x	Sp	20
Act#21	46	BUDS ON TREES----------			x	x	x	x	x	W,Sp	24
Flora											
Act#23	49	SPORE-BEARING PLANTS-------				x	x	x		E,Sp,Su	15
Act#24	51	DECOMPOSERS----------				x	x	x		F,Sp,Su	14,15,17,18
Act#25	53	TREE STUMPS AND ANNUAL RINGS----------					x	x		All	29
Act#27	57	PLANT IDENTIFICATION-------					x	x		All	20,21,22,23
Act#29	61	FLOWER FUNCTION----------			x	x	x	x		Sp,Su	9
Act#30	63	FLOWERS----------					x	x		F,Sp	10,11
Act#31	65	STEMS AND BUDDING----------				x	x	x		All	9,24,25
Act#32	66	TREE IDENTIFICATION--------					x	x		All	3,30
Act#36	72	CONIFERS----------				x	x	x		All	28,80,81

ACTIVITY MASTER KEY
LEVEL III cont.

	PAGE	TITLE	Level K	1	2	3	4	5	6	Season	Follow-Up
Fauna											
Act#37	73	INSECTS AND PLANTS					x	x	x	F,Sp,Su	-
Act#39	77	ANTS						x	x	F,Sp,Su	36,37
Act#40	78	INSECTS						x	x	F,Sp,Su	34,35
Act#41	79	LISTENING TO AND LOOKING AT INSECTS						x	x	F,Sp,Su	34,35
Act#42	82	SPIDERS						x	x	F,Sp,Su	38
Act#43	86	SPIDER WEBS						x	x	F,Sp,Su	39,40
Act#46	92	SPIDER WEBS						x	x	F,Sp,Su	39,40
Act#47	95	EARTHWORMS						x	x	F,Sp,Su	32,33
Act#49	100	BIRDS					x	x	x	F,Sp,Su	46,47,50,51
Act#50	102	HEARING AND DESCRIBING BIRDS					x	x	x	F,Sp,Su	49,50,52
Act#51	104	FIELD STUDY OF BIRDS					x	x	x	F,Sp,Su	47,48,50,51
Act#52	106	BIRDS: Observing Habitat and Anatomy						x	x	F	47,49,52
Habitat Studies											
Act#53	109	ANIMAL TRACES IN WOODED AREAS					x	x	x	All	41,42,43
Act#56	114	MATURE FOREST: Layers					x	x	x	F,Sp,Su	42
Act#58	116	FOREST AND FIELD					x	x	x	F,Sp,Su	54
Act#62	122	SAPLINGS AND FIELD SUCCESSION						x	x	F,Sp,Su	25,54
Act#63	124	WOODS AND FIELD-THE EFFECTS OF LIGHT						x	x	F,Sp,Su	25
Acr#65	127	STREAM STUDY				x	x	x	x	F,Sp,Su	53,58
Act#66	129	POND SUCCESSION					x	x	x	F,Sp,Su	65,66
Act#67	131	MARSH: Plant Life				x	x	x		F,Sp,Su	63
Act#68	132	MARSH: Animal Life			x	x	x	x		F,Sp,Su	53,55,61,62
Act#69	133	MARSH LIFE				x	x	x		F,Sp,Su	53,55
Act#71	138	MARSH FOOD CHAIN						x	x	Sp,Su	53,62,64
Act#72	140	MARSH SURVEY						x	x	F,Sp,Su	53,58
Weather, Geology, Soils, Hydrography											
Act#75	146	RAINY DAY						x	x	All	68
Act#76	147	RAINY DAY					x	x	x	F,Sp,Su	68

ACTIVITY MASTER KEY
LEVEL III cont.

PAGE	TITLE	Level K	1	2	3	4	5	6	Season	Follow-Up
Weather, Geology, Soils, Hydrography cont.										
Act#78 152	WINDY DAY IN A FOREST-----	x	x	x	x	x	x	x	All	68
Act#80 154	ROCKS AND MINERALS--------					x	x	x	All	73
Act#82 157	SOIL----------------------				x	x	x	x	F,Sp,Su	16-18,69-72
Act#83 159	EROSION (RAINY DAY)-------				x	x	x	x	All	67
Act#84 160	HYDROGRAPHIC STREAM STUDY-						x	x	All	58
Awareness, Man and Nature										
Act#88 167	MAN AND HIS WORLD---------			x	x	x	x	x	All	57,74,76,78,79 82

TO THE TEACHER OR GUIDE

This is a guide and not to be considered the alpha and omega of a field trip. No one can foresee all the variables of events or interests of children.

Children in the first years of school have an extremely short attention span. They love to be "detectives" or "explorers". First year children differ in experiential backgrounds, so language development and concepts vary greatly.

At all levels:

Do not talk down to the children, but be clear, concise and use proper names.

Give only as much information as the children can assimilate and recall fairly easily. The object is to stimulate, motivate, and interest the child in the out-of-doors. Suggest that an especially interesting feature of the trip would be a good topic for further investigation at school.

Be sure the children are dressed for the weather and the out-of-doors. Clothing that is adequate for a ten minute recess on a paved playground may be uncomfortable for an hour in a snowy or muddy woods.

Establish ground rules and the reasons for the rules at the trip site just before you begin. (Some general rules are necessary for any outdoor area that will be visited by many people). This can be done by questions to involve the child such as: "What can you do or not do during the trip to keep the area as nice as it is now?" "What is the reason for this rule?" We have had success in asking that three rules be followed:

1. Be careful to protect plants and animals from harm.
2. Keep trash with you.
3. Leave even the most interesting things for others to see.

Suggest "What you can do during the trip is use your senses." The concept of five senses may be new to younger children while the older ones are usually familiar with it.

During the trip remain with the general topic and the format of questioning the children as in the O.E.C. Activity Sheets, but don't try to follow the sheets word for word. Use the objects discovered and the events of the trip as they occur, and if possible relate to the trip topic. All living things in an environment are so interdependent this is usually very easy.

Try to have the children answer their own questions by questioning them.

Example:

Trip topic is Animals. Child picks up a walnut shell with a hole in it. An imaginary but typical exchange could be:

C: "What's this?"
A: "What do you think?"
C: "I don't know."
A: "Is it a leaf? a flower? a pineapple?"
C: (Looking at guide oddly) "No, it's a nut of some kind."
A: "Do you think it grew with that hole there?"
C: "No."
A: "Then how do you suppose the hole got there?"

From this beginning the adult might question why the hole was made and encourage examination of the interior of the shell to confirm suspicions that the nut "meat" might be missing. Much would have been lost if the answer to the first question was, "It's a walnut."

Don't be afraid to say "I don't know" to the children and to speculate with them on possible answers. Nobody knows all about natural history and ecology, which helps keep this study fresh and continually interesting.

THE INTERDEPENDENCE OF LIFE: THE RELATIONSHIP OF MAN, ANIMALS AND PLANTS TO EACH OTHER AND TO THE ENVIRONMENT

Orderly laws appear in nature. These laws seem to govern the distribution and success of living things. Do you think these laws apply to humans? to plants? to other animals? to all as a group of organisms living together?

What was the area like before man came here? What kinds of changes have occurred in the topography of the land, the soil, the plants, the animals? What has happened to the area since the appearance of man? What happens to organisms after man invades virgin territory to construct buildings and highways? Are there plant and animal species present that would not have been here if man did not alter this environment? Was man responsible for the introduction of new plants and animals and the extinction of once native organisms? What has happened to this biome since man has come and gone? What is a biome (community units, regions - examples, tundra, northern coniferous forest, temperate grassland, temperate deciduous forest, etc.)?

Relationships among different plants and animals are orderly. Is this relationship also true for man? Is man the only organism that can manipulate the environment? Can other organisms manipulate the environment? How? What are the relationships of abiotic factors such as light, moisture, temperature and nutrients to the plant communities, to the animal community, and to man? How do they all interrelate for the establishment of a habitat of good quality? What is the difference between abiotic substances (nonliving) and biotic substances (living)? List some examples of each. How do they affect each other?

What kinds of communities do we find in this ecosystem? What is a community? (Living part of an ecosystem, any assemblage of population.) What are the inter- and intrarelationships found in these communities? Are there any dominant communities in this ecosystem? What is an ecosystem? (Major units in which all living and nonliving factors of the environment are integrated. Example - land and water ecosystems.) What are the factors that allowed these plants and animals to dominate this particular region? What relationships do they impose on one another? on man?

During winter months, snow can be used to illustrate some of the abiotic factors that bring about changes and how these factors affect living things. What is its relationship to man? to plants? Is snow beneficial to living organisms? Is it destructive in any way? What is the snow's relationship to the water table and how does this relate to all living things?

Salt is used to melt the snow. Does this salt have any harmful effect on plants and animals? Does it have any effect on man? Any abiotic factor (such as - light, temperature, climatic conditions, weather, moisture, etc.) or biotic factor during any season can be used to demonstrate the relationships that exist in an environment.

A DOZEN CONCEPTS...
for Environmental Education

As you may have noticed, NATURE STUDY now is subtitled "A Journal for the Advancement of Environmental Education." It is our belief that environmental education should have certain concepts as its objectives. The following concepts should be considered as goals in the development of programs in indoor/outdoor education. No relative degree of importance is indicated by the order in which they are listed.

1. Man is able to damage and destroy the environment and its ability to sustain life. We possess enormous capacity for such destruction through machines and sources of energy only recently invented. We do not know the long-range impact of these activities on the natural environment - evidence indicates that many of our actions may have long-range bad effects.
2. Man is a product of the natural world, and is adapted to it. This adaptation is controlled and perpetuated by thousands of almost unchanging genes. This means that the world environment must be sustained essentially in its natural (i.e., precivilization) state or we, along with most other creatures, will succumb.
3. Man depends on the biological organisms with which he shares this planet for his own health and well-being.
4. Man is himself a biological organism, and his basic bodily needs are the same as for most other creatures.
5. The natural world is extremely complex. Like any complex organism or machine, there are many interacting parts and all parts are interdependent. All parts of the system must function properly or the whole system suffers. (The analogy with the human body, or with our community social structure, works well here.)
6. The proper functioning of one's body, or of the natural world (the ecosystem), depends on the fitness of the structures which make them up. This is easily seen in our own bodies, but may be hard to see in the ecosystem, where the functional parts are difficult to define and harder to analyze.
7. All things in nature must be cycled, so that they can be used over and over again. Some elements are cycled rapidly - carbon, water, oxygen, nitrogen. Others more slowly, through geologic processes- minerals deposited, uplifted, eroded. The materials of the earth are in limited quantities, and must be used again and again. Wastes of human activities must be salvaged and reused if future generations are to have the necessities of life.
8. Diversity is a necessity in the living world. The survival of any species will be in part dependent on the variations which it contains within itself. Man, in his ignorance or for selfish reasons, tends to simplify the world in which he lives, through monoculture of plants and animals, extinction of whole species, and destruction of specialized habitats (such as wetlands).

9. All living things have a right to exist in suitable habitats. Mankind's ability to change the face of the earth must be carefully exercised. Too drastic change is not only detrimental biologically, but may be indefensible morally.

10. Natural environments have important therapeutic effects on urbanized man, as witnessed in literature, art, music, reaction, wilderness, etc.

11. We must have within ourselves a sense of awe and wonder, a humility with regard to ourselves in relation with the natural world. Many of our problems of environmental deterioration are due to man's egotistical "above nature" attitudes.

12. We must translate ideas into feelings. People usually do what they feel like doing, not necessarily what they know they should do. The teacher must keep this fact ever in mind, so as to take advantage of those opportunities whereby students may develop attitudes friendly to nature and natural phenomena.

This editorial has been reproduced from the Summer 1969 issue of Nature Study and was written by John A. Gustafson.

ACTIVITY #4 Birds in Autumn

OBJECTIVES:

Students should be able to:

> Describe the activities of the birds seen on this trip.
> Find at least two plant foods available to birds in the area visited.

If birds were studied the previous spring, children should be able to describe the differences noted between spring and fall birds in terms of song, color and activity.

In the weeks following the trip, students should demonstrate an increased awareness of animal activities, as evidenced by their reporting, either informally to the teacher or more formally to the class, observations made of birds and other animals, especially as these seem to relate to preparation for winter.

THE TRIP:

This activity is best used with a class which has studied birds in the spring prior to this. However, it can also be used as an introduction to the wintering habits of animals.

How many different kinds of birds do you see? How many of one species do you see in this immediate area? Stand in one place for several minutes and count all the birds of one species you see.

How do they look? Do the colors seem as bright as in the spring? Do you see any young birds? What makes you think they are young? Can you pick out males and females?

What foods are available for birds here now? Are they eating this food? Is there anything here that you think will be winter food? Do all birds eat this kind of food? What have you seen birds eating that they won't be able to find in winter? What do most people say birds do during the winter? Have you observed anything today that would make you think the birds are getting ready to fly south? Do you think you have observed enough to conclude that they are?

ACTIVITY #5 Seed Dispersal: Field & Forest

OBJECTIVES:

At the completion of this field trip, the student should be able to do the following:

Name and describe several methods of seed dispersal.
Given different kinds of seeds common to the field trip area, match the seeds with the trees or other plants that produce them.

THE TRIP:

Look carefully into the air.
From what direction is the wind coming? How do you know?
Do you see anything being blown by the wind?
Do you see anything being carried from one place to another by the wind?
Are these things natural objects or man-made materials? If natural materials, are they animal or plant parts? How can you tell? Do you see any wind-borne seeds?

Walk through a field, along a hedgerow, or some similar area where "weeds" grow.
Examine your clothing. Is anything sticking to your clothing? What is it?
Look carefully with a hand lens at the seeds "sticking" to your clothes. How do they "stick"? Can you find the plants these seeds come from? Do they have seed pods? How do seeds leave the pod?
Can you find a seed that is, has been, or could be wind-borne? What is there about the seed that makes it possible for it to be carried by the wind?
How are these seeds dispersed? Is man the only animal disperser of these seeds? What other animals might do this?

Now that we've seen how seeds of small plants are dispersed, let's examine some tree seeds.
Look at the branches of trees.
Can you find any fruits, pods,nuts?
Examine the ground beneath the trees. What do you see, other than leaves, that might have fallen from the trees? Did you find any seeds or seed castings? Have any of these seeds started to grow? Have you found any tree seeds (such as acorns, beech burrs, hickory nuts, tulip tree seeds, or others) which are not under trees?
What means of dispersal do you think has occurred?

ACTIVITY #7 STORIES IN SNOW

RELATED AREAS: Signs of winter
Animals in winter
Air pollution
Light and color

MATERIALS NEEDED:
Thermometers
Yardsticks
Spring Scale fastened to tray

OBJECTIVES: Children should be able to

1. Distinguish between tracks and other marks in snow
2. Given reference pictures, identify the tracks of common local mammals
3. Describe the changes that occur in a patch of snow with the passing of time.

What stories can you find in snow? Are all the marks tracks? What kind of animal do you think made the track? Was it an animal that had paws like a dog or cat? Was it a bird? How would you describe the shape of the tracks? Are they all alike? What do you think was the shape of the foot that made the tracks? Did it have claws? Were the front and back feet alike? Did the animal have two feet or four? How big do you think the animal was? Why? (Measure the size of the tracks, and the distance between the tracks.) Was the animal hopping? running? Did it keep two feet together, like a rabbit, or move with feet alternating, like a dog? Was it just crossing the snow, or did it stay on the snow patch? What makes you think this? Where might it have come from? Where might it have been going? Might it have been following some other animal? running away from some animal? Why do you think this? Did this animal have a tail? What makes you think this? Was it carrying or dragging anything? Does this area seem to have been visited by many animals of this kind? of any kind? How recently do you think these tracks were made? If there is more than one set of tracks, can you tell which set was made most recently? longest ago? (Note: if snow is old, with many tracks, look for trails or trail crossings.)

What made the marks that are not tracks? Did something fall on the surface of the snow? Was the mark made by something that was under the snow? If so, how did it get there? Is the thing that made the mark still there? Where? Why do you suppose it is still on the surface? sunk into the snow? If you cannot find the thing that made the mark, can you guess what made it? (Note: Watch for wind ridges, circles made by blowing grasses, and drop marks made by snow melting or falling from branches overhead.)

What color is the snow? Does it appear to be the same color all over? Does the color change as you change your location? Are there differences in color in the sunlight and in the shade? What color are the shadows? Is the surface the same color as the snow an inch down from the surface? If not, how would you describe the difference? How would you explain it? Where did the dirt on the surface of the snow come from? How did the dirt get into the air? Where would it have gone if it hadn't landed on the snow? Where will it go when the snow melts?

How long ago did this snow fall? Is there more or less snow here than in your yard? Why do you think this is? Did more snow fall here? Why? Is there snow here from only one snowfall? How can you tell? (Cut a cross-section in the snow for study.) How many falls can you count? Which seems to have been the deepest fall? Compare depths with memories of recent falls. What seems to happen to snow after it has been on the ground for awhile? Can you offer suggestions as to what causes these changes? What would happen if some of this snow did not melt this summer, but stayed here next winter, and then had more snow fall on top of it next year? What happens when you push down on the snow? (Cut a piece of snow six inches square. Weigh it by placing it on a tray to which a spring scale is attached. Cut pieces from the top layer of snow, and compare the weight of them with equal-sized pieces from the bottom layer).

Is the snow the same depth all over the field (patch, playground)? Where is it deepest? least deep? Can you explain these differences? (If there had been more than one fall, cut several cross-sections to see if all falls record the same depth- distribution pattern. If not, what do you think caused the difference?

What is the temperature of the snow? Is it the same temperature on the surface as deeper? Is it the same temperature in the shade as in the sun? What is the temperature of the ground under the snow? How does this compare with the temperature of the ground where there is no snow? Compare the temperature of the snow with the temperature of the air. Is the snow melting now? Does there seem to be more melting at the edge or in the middle? What makes you think this? Is there any difference in temperature at the edge and in the middle? What is the temperature of the melt-water? of the air? of the snow? (Look for evidences of melting under the snow. Why would melting occur here?) (Note: theheat of the earth.) Is there any indication that the snow has melted other days? If so, and if it is not melting now, what is the edge of the snowbank like? Is there any ice? What has happened to the surface? Has melting occurred evenly all over? (Note: In some parts of our country, depressions in an old snowfield are called sun-cups.) What has

happened where leaves have fallen on the surface? Why have some leaves sunk into the snow?

(Note: See follow up on light, color, temp. - dark colored objects absorb more of the heat from the sun, and melt the snow beneath them.) What reasons can you suggest for more melting to have occurred around taller blades of grass, sticks, or other protruding objects? (Note: Living things continue to metabolize even during winter. Some heat is given off by grasses and other plants.) Does melting seem to have occurred anywhere that you would not expect, or where there seems to be no visible explanation of the melting? What is the ground like at the edge of the snowbank? How does it differ in appearance and feel from the ground away from the snow? What does the grass look like where the snow has recently melted away from it? Why do you suppose this is so? (The snow cover acted as blanket, warming the grass, and provided the moisture for growth.) Where is the water from the melting snow going?

ACTIVITY # 11 The Marsh in Winter

MATERIALS NEEDED:

Thermometers, some fastened to the ends of long sticks; hand lens, dip net, enamel tray, glass jars, pencil, paper.

1. A Marsh Covered or Partly Covered with Ice

Where is the ice?
at the edges or in the middle? Why do you suppose it is not along the edges, in the middle, all over the marsh? at the surface or on the bottom? Is there ice around rocks or other protrusions? on all sides? Is the ice directly on the surface of the water, or is there space between the ice and the water? Why might this be?

Do you think this ice is just forming, or beginning to melt? Why?

Is the ice smooth? If not, how would you describe the surface? What do you think made the marks (patterns, ridges, bumps)? (NOTE: If snow was falling when the temperature dropped below freezing, or has since fallen and crusted on the surface, lead children to observe this.) What color is the ice? Is it the same color all over the marsh? Would you call ice grey, white, silver, or some other color? Is it transparent? translucent? opaque?

What designs or patterns can you find? Where have you seen patterns like this before? (Lead children to recall frost on windows). How thick is the ice? Is it the same thickness everywhere? How does the thickness affect the color? Is anything frozen into the ice? At what depth or depths is it held? (Note that some leaves appear to have a "rind" or frost-coating surrounding them within the ice; others have air pockets or bubbles near them.)

Look carefully at the ice. Can you find any evidence of air that was in the water?

II. A Marsh With or Without Ice

What is the color of the water?

How cold do you think the water is?
Which do you think is warmer, the water or the air? Now take the temperature. Were you right? What is the temperature of the air? of the water at the surface? of the ground at the edge of the marsh?

Do you think the water near the bottom is colder or warmer?
(NOTE: Before putting the stick with the thermometer attached into the deeper water or mud of bottom, check first for depth, solidity of bottom, etc., to avoid breaking thermometers.)
Take temperature of water a foot below surface. Take temperature of mud on bottom. Make a chart of water temperatures at varying depths and varying distances from shore. (NOTE: scientists have discovered that some water can be below the freezing point, and yet still be in the liquid form. It is called super-cooled water.)
Is it colder closer to shore or toward the middle? Why do you suppose this is so?
Why do you suppose the temperature (rises, falls) as we go deeper?

If the ground is frozen along the bank, how far below the surface of the marsh is the mud of the bank frozen?
Do you think anything could be living in the marsh now?
If there is ice on the marsh, how would living things breathe? What would they eat? Could any plants in the marsh be alive? (Take water and mud samples and examine them with hand lens. If possible, examine some under a microscope. Try to identify specimens and determine how they survive the low temperatures.)

III. Marsh and Stream

What is the difference between the marsh and the stream?
Is there any difference in the depth of the water?
Is there any difference in how fast the water is moving?
Is there any difference in the amount of ice, location of ice, appearance of ice? Is there any difference in the temperature?
Which seems to freeze more quickly, a marsh or a stream? Why?
Which seems to thaw more quickly, a marsh or a stream? Why?

IV. Marsh and/or Stream

For discussion:
What do you suppose would happen if the marsh/stream water froze all the way to the bottom?
If we had a mild winter, and the marsh did not freeze at all, what differences would you expect to find in the spring that you would not find in a spring after the marsh had been frozen?

Do you think evaporation takes place while the marsh is frozen? Why or why not? How could you find out?

ACTIVITY #16 Tree Buds

MATERIALS NEEDED:

Pencils

OBJECTIVES:

While on the trip, students should be able to:

- Find at least three buds which open with leaves in different "packaging" arrangements.
- Count the number of leaves emerging from one bud and make comparisons with buds of same and different species.
- Differentiate new growth from old on evergreens.
- Locate at least one plant which has bloomed, one which is in bloom, and one which has not yet bloomed.

Given a variety of trees which "leaf-out" at differing times, students should be able to distinguish the ones which leaf early from the ones which leaf late and to realize that not all trees bloom or produce leaves at the same time.

In the weeks following the trip, students should:

- Demonstrate a continued interest in opening buds by observing and bringing in examples of leaf buds which unfold in ways similar to or different from those observed on the trip, and/or by bringing in branches for class observation.
- On their own initiative, carry out some of the follow-up activities suggested. (See Follow-up Master Key Index)

THE TRIP:

Do all buds open at the same time? Examine a variety of trees before coming to a conclusion.
Can you find some trees and shrubs whose leaves seem to be completely unfurled before other trees have begun to open? Do all trees of a given type leaf-out at the same time? Do all the buds on one tree open at the same time?

Are leaves full-sized when they emerge?
Are all leaves on a given tree the same size?

Observe the orientation of the leaves as they emerge. Do they "hang down"? Are they "held up"? Are they "thrust out"? Try to use descriptive phrases in telling about them, such as "rabbit ears", "a handful of playing cards", etc. Try to sketch some of these arrangements.

How have the leaves been packaged in the bud?
Find a tree whose leaf emerges folded in half. (Tulip tree)
Are both sides of such leaves exactly alike?
Find a tree whose leaf emerges accordian pleated. (Beech) Is there any relationship between this and the veining pattern?
Find a tree whose leaf emerges curled. (Willow)

How many leaves come out of one bud? Is the number the same for all buds on a given tree? for all trees of a given type?

Observe the bud scales from which the leaves are emerging. What color are they? How does their texture compare with the texture of the leaves on that tree? Compare the bud scales on different trees.
What becomes of the bracts after the leaves unfurl?
Compare flower buds and leaf buds.
Which open first on dogwood? maple? etc.
Do the leaves and flowers come from the same buds?

Let's find an evergreen tree. What are the leaves on an evergreen? Can you find buds on this tree? Where are last year's leaves? Is any part of each branch a different shade of green? What part?
Where would you expect to find buds on a branch?
Feel the light green tips. How do they feel? How do they feel in comparison with the darker needles? What might explain the difference?
How does an evergreen grow?
Are there any other kinds of "buds" on these trees?
What do you suppose they are? Why?

ACTIVITY # 18 Mayapple, Jack-in-the-Pulpit

OBJECTIVES:

Given a list of 15 characteristics of plants, the student should be able to categorize them in three groups: those describing only the mayapple, those describing only the jack-in-the-pulpit, and those describing both.

THE TRIP:

Examine a jack-in-the-pulpit. Does this plant have flowers? Where are they? How are they different from most flowers you have seen? How are they the same?

Do all jack-in-the-pulpits have the same kind of flowers? (Allow time for investigation. Describe the differences.)

Which of the flowers do you think are male, the white, dusty ones or the round, closely packed green ones? (Compare stamens and pistils if class has studied the parts of a flower.)

Examine the "pulpit". If this isn't part of the flower, what is it? What does it resemble? What else is green and has veins? Compare the "pulpit" to the leaves on the same plant. What are the similarities? What are the differences?

Check about twenty "jack-in-the-pulpit" plants. About what percentage of these are female? Find a second and third group of plants. Is the percentage of female plants about the same? If results are about the same, discuss reasons for this proportion. Should we call all these plants "jack-in-the-pulpit"? If not, can you suggest another name for the female plants?

Find a patch of mayapples. How many leaves are there on each stem? What is the shape of the leaf? the texture? Where is it attached to the stem? How many divisions are there in the leaf? What is the smallest number you can find? the largest? What color are the leaves? What color are the stems?

Can you find any buds or flowers? Does the bud form at the same time as the leaf or later? How can you find out? Where will the fruit be in the fall?

Do mayapples have male and female plants or do all flowers contain both the pistil and the stamens? (If you cannot find open flowers on the mayapples now, how could you find the answer to this question?)

ACTIVITY #19 Flowers

MATERIALS NEEDED:

Flower field guide very helpful.

OBJECTIVES:

After completion of this exercise, the children should be able to:

Make a list of colors and shades of colors found in plants.
Recognize and identify five different flowers.
Draw five different generalized leaf shapes.
Give a functional definition of a flower.

THE TRIP:

How do you know it's Spring?
And how do you know it's Fall?
Suppose your eyes were always shut
And you couldn't see at all.
Could you smell and hear the Spring?
And could you feel the Fall?

Margaret Wise Brown

Walk along the trail and look around you. How many different colors do you see? Name them. Is all the green the same? If not, how does it differ?

What different kinds of flowers can you see from where you stand? (You don't need to name them; just describe them.) How can you tell that those at a distance are flowers? Do some flowers grow on trees, or are they all on smaller plants? Can you find any plants that have no flowers?

Find some flowers and take a close look at them. Are they the same color all over? How do they vary? What shape are they?

Apply the same questions to other flowers nearby.

Are flowers all regular in shape or are they irregular? Do they all have the same number of petals?(Make a list of various numbers.) What different shapes are the petals? (Draw some of their outlines.)

Look at the leaves. Are they all the same color? shape? Draw some leaf outlines of different kinds.

Can you find some flowering trees? (Not all trees have obvious flowers.) See if you can see how some of the flowers might develop into fruits. (Red maple, apple.) Can you find a green flower? (Grass, spice bush, sedge.)

Look for mayapple plants. Do they have a flower? What color is it? Which ones have the flower? Is this always true? Count the leaflets. Does each have the same number? Make a list of different numbers. Is there a number which predominates?

Do all the flowers you have examined have petals?

Do all plants have flowers?

Discuss the function of flowers, bearing in mind this will need more than the present observation.

ACTIVITY #20 Flowers

MATERIALS NEEDED:

Magnifying glasses; flower and tree guides (optional)

OBJECTIVES:

The student should be able to:

Name at least three common spring wildflowers and tell one distinguishing characteristic of each.
Name two fruit trees and three other trees which have flowers.
Give a functional definition of a flower and name two criteria he could use in deciding if a plant part is a flower.
Give a functional definition of flower parts in relation to seed production.

THE TRIP:

What kinds of flowers do you think of when you think of spring?
Where do you expect fo find flowers?
What colors do you look for when you look for flowers?
How do you know a flower when you see one?
Do all flowers smell sweet?

NOTE: Children will easily see the colorful familiar wild flowers, but will probably overlook the less colorful flowers which are wind-pollinated. The "showy" flowers, both colorful and producing scent, are generally insect-pollinated. Using lead questions encourage your class to observe less conspicuous flowers such as those of oak and maple trees.

Who can find a yellow flower? a white flower? a pink or purple flower? a green flower?
What parts do flowers have? What is the function of these parts?
Can you find these parts on all flowers?
Can you find flowers which will not self-pollinate easily?
How can you tell?
Is "Jill" ever in the pulpit instead of "Jack"? What can you find that would answer this question?

What kinds of flowers might we look for that we haven't thought of? Where can you look? Did you think to look above your heads? (NOTE: The flowers on the oak trees will probably be too high above for children to see, but broken twigs with flowers and young leaves are often found on the ground.) Are the "catkins" of the oak male or female flowers? (The female flowers are found in the leaf axils.) Do all plants have flowers?
How can you tell, in the fall, what plants flowered in the spring or summer?
How would plants that don't have flowers reproduce? In the next weeks, see if you can find examples of plants that don't have flowers. (NOTE: Examples of these are algae, moss and mushrooms.)

ACTIVITY #21 Buds on Trees

MATERIALS NEEDED:

Hand lenses, tweezers, knife, paper, pencils.

OBJECTIVES:

Students should learn to use tree buds to help identify trees. Students should begin to discriminate between leaf and flower buds.

THE TRIP:

Can the leaf buds be distinguished from the flower buds? (Usually you can't tell these buds apart by just looking at them. Cutting such buds open lengthwise, the leaf bud will have a number of small undeveloped leaves. The flower bud contains one or more miniature or undeveloped flowers but no foliage leaves. In some cases mixed buds (apple, lilac) containing both leaf and flower structures will be found.)

What purpose does the bud scale have? New leaves and/or flowers enclosed in buds are usually protected by several layers of overlapping scales, called bud scales, which are really modified leaves. Bud scales are maybe covered with hair (willow) or a waxy secretion (cottonwood). (They protect the enclosed structure from drying out and from injury.)

When are buds formed? (They begin to form during the summer of the preceding year. They are called winter buds because they live through that part of the year.)

Observe the position or location of the buds on the twig. Some buds form on the ends of the stem (terminal buds) and some develop along the sides of the stem above leaf scars (axillary buds). Adventitious buds form anywhere on the stem except at the tip and above the leaf scars.

Variations among buds can be observed by looking for characteristics such as:

1. Shape
2. Number of scales
3. Presence or absence of hairs

What size are the buds? Are all the buds the same size? Can you find buds of different sizes on the same tree?

What color is the bud? Is all of the bud the same color?

What shape are the terminal buds? Compare the terminal buds with the lateral buds in size and shape.

Use the hand lens to observe the bud scales closely. Describe what you see. (Perhaps the margins of the bud scales will be covered with fine hairs.)

Can you count the scales on the terminal bud? Describe the scales.

How are the buds arranged on the twig? (In bunches, opposite each other, alternating?)

Note: It is best to have students bring buds and twigs from home to avoid wholesale defoliation of a study area. Many areas have a "no picking" rule for this reason.

Students could also "force" buds to watch them develop. Ask students to bring several small twigs to school. Maple, lilac, and forsythia are especially good. Put the twigs into containers of water and the class will be able to see the twigs bloom indoors.

ACTIVITY #23 Spore-Bearing Plants

MATERIALS NEEDED:

Hand lens, identification keys.

OBJECTIVES:

After the completion of this trip, the student should be able to do the following:

Name at least three observed differences between seed-producing plants and spore-producing plants.
Identify, from pictures or specimens, mosses, ferns and fungi.

THE TRIP:

Ferns:

Observe the ferns that you find.
Do you see flowers or fern plants?
Do you see fruits or seeds on these plants?
Describe both sides of the fern leaves. What is the difference between the two sides? Make a diagram and describe any differences.
Compare the fern leaves with leaves of other plants in the area that are not ferns. List specific differences.
How large do you think these ferns will grow? What makes you think this? Through observation, can you find many ferns that give you some idea of the size of most ferns at maturity?

Mosses:

Observe mosses in the woods.
What color are the mosses that you have found?
Do you see fruits or seeds on the mosses?
Examine the mosses with a hand lens. Do you see leaves?

Do you see stalks? Do you see stems? Do you see flowers or flower parts?
Do the mosses have roots?
Feel the mosses. Describe how they feel.
Have you ever seen flowering mosses?
Do mosses have seeds? How do you think they reproduce?

Fungi:

Observe any fungi that you may find.
Where have you found fungi growing? Describe the soil or other materials where you find fungi growing.
Are there flowers, fruits, and seeds on the fungi?
What colors are the fungi?
Are the fungi the same color as the mosses and ferns?
Look at the bottom side of any mushrooms or toadstools that you have found. What do you see?
In what ways have you found the ferns, mosses and fungi to be alike? In what ways are they different?

ACTIVITY #24 Decomposers

OBJECTIVES:

Students should be able to:

Differentiate between living and decomposing wood.
Find examples of decomposition in their yards and near the school.
Demonstrate an awareness of the importance of the decomposers by such means as encouraging the use of a compost pile in home gardening.

THE TRIP:

Do you think these trees are dead? Why?
What is the difference between a dead tree and a living one?
What will become of these trees? Suppose they are not taken away from here?

Is the bark still on all the logs?
What is under the bark?
Tap on the bark. How does it sound? How does this compare with the sound of the living trees?
Feel the bark and the wood under it.
How would you describe it?
Does it feel the way it looks?
Does all the wood under the bark look the same? Feel the same?
Push and poke it. Can you find some that is fibrous? spongy? powdery?
What other words can you use to describe the way it feels?
Is there anything on these tree trunks and logs besides bark?
Is this material living or dead? Why do you think so?
What color are fungi? (NOTE: Although white or grey will probably be the answer, suggest they look more closely for other colors with such questions as: Are they all the same shade of white? grey? Can you find fungi that are striped? brown? orange or reddish black? cream colored? some other color?)
How would you describe the appearance of fungi? Can you find fungi that are: semi-circular, flat, or needle-like?
Are all the fungi living? Why do you think this?
Can you find fungi that look like open umbrellas? closed umbrellas? a deer's antlers? What other ways could you describe them?
From looking at them, how do you think fungi feel?
How do they really feel?
How many different textures can you find? Can you find fungi that feel velvety? leathery? granular? like paper?
What other words can you use to describe them?

Can you find signs of other organisms that are or have been in these logs? What signs?
What do you think made the holes? marks?
Does the animal which made the hole seem to be there now?
What makes you think this?
What part might this animal have played or be playing in the death and/or decomposition of this log?
On what observations, if any, are you basing your answer?
Might there be some other explanation? How could you find out?

Have all these logs been lying here the same length of time?
What makes you think this? Find the one you think has been here the longest. Where does the log stop and the forest floor begin?

Should we "clean" these woods and remove these logs?
Why do you think this?

Is there any other place in this forest where decomposition is taking place? How about in the field? in your yard and garden? What would the world be like without the decomposers?

ACTIVITY #25 Tree Stumps and Annual Rings

MATERIALS NEEDED:

Tape measures, compasses, pencil, paper
(Optional: adding machine tape, crayons)

OBJECTIVES:

Children should be able to:

Count the annual rings on a cross-section of a tree to determine the age (within a five year accuracy).
Take a compass reading and identify the directions north, south, east, west, and the intermediate directions northeast, southeast, southwest and northwest.
Be able to determine in what direction one object lies from another.
Use a tape measure to measure the circumference of a stump to within a 1" accuracy.
Compare the circumferences of two or more stumps to determine which is larger and compare the ages of two or more stumps to determine which is older.
Locate the "starting point" of the tree by finding the smallest annual rings.
Measure the distance from the smallest annual ring to the edge of the stump in four directions: North, south, east, and west.
Compare the amounts of annual growth, determining periods in which the tree grew more than others.
Recognize signs of injury to a tree from deformities in the annual ring pattern.
Find an average from data collected in the field.
Tell at least three things which may be learned about a tree's life history from observing the stump.

THE TRIP:

What sort of stories can a dead tree tell you?

How can you find out how old a tree was?
Can you find at least two stumps that tell you how old the tree was when it was cut down?
Which is the bigger of the two stumps you found? How much bigger?

(NOTE: It will be easier for the children to measure the circumference of each tree if they work in pairs.)

Which was the older when it was cut? How much older? How old was each? Was the bigger one older? If not, can you guess why not?
(NOTE: Allow time for discussion of this point. Suggestions may be made which will lead into the following suggested investigations or into other investigations.)

Does a tree grow the same amount each year? What evidence can you find to support your answer?
Did each of the trees whose stumps you are looking at grow more rapidly during its first ten years of life or during its last ten?
Assuming the two stumps you are observing were cut the same year, is there a correlation between the amount of growth of each tree during the last 10 years of their lives?
(NOTE: It will probably be necessary to give the example: "Suppose both trees were cut in 1965. Did both grow more during 1964 than during 1963? Did both grow less during the last five years of their lives than during the five years just before that? Assuming they were both cut at the same time, would the last five years of the life of each be the same calendar years?")

(NOTE: If a student thinks his two stumps were not cut during the same year, explore what observations he has made that have led him to this conclusion. Then, for this activity, he may find two stumps that appear to have been cut at the same time and pursue this investigation if he wishes.)

Does a tree grow equally all the way around? What makes you think this?
Did you reach this conclusion after examining only the two stumps?
Check at least five before coming to a conclusion.
What may explain the differences in growth? (Allow time for investigation and speculation.)
What observations led you to these ideas?
Does the stump have any close neighbors? on which side are they? Be sure to include other stumps as neighbors.
Are there any signs of injury or damage?
Do trees grow less on the side facing a specific direction? What direction? Take a compass reading. How many stumps should you check before you make inferences about this? Can you safely make such inferences after studying the stumps in this part of the forest only? Why?

Measure the distance from the smallest annual ring to the edge of the stump in each direction. (See sketch.) Be sure to record your measurements and the directions.

Make a tracing of the annual rings of one of your stumps. Make the tracings in the four directions measured above. Label the directions. Then measure the distance from the stump to its nearest neighbors. Record these distances and the direction of each "neighbor" from the stump. How big are the "neighbors"? About how long do you think they have been there? Would they have had any influence on the growth of your tree during its early years? Later years? Why do you think this?

Optional Activities for Math

Is the smallest annual ring in the geometric center of the stump?
(NOTE: In the classroom, the correspondence of the geometric center and the growth center may be compared with the location of the South Pole and the geographic center of Antarctica.)

If the geometric center of the stump is not the same as the smallest annual ring, how would you determine the diameter?
Will you get the same diameter each time you measure the stump?
Make five measurements and find the average.
Is the perimeter of the stump the same as its circumference?
How would you explain any variations you found?

ACTIVITY #27 Plant Identification

OBJECTIVES:

Students should be able to list the six groups of plants found on the trip. They should be able to describe at least two distinguishing characteristics of each group and to name or describe, in words or by sketching, at least two representatives of each group.

Within the weeks following the trip, students should evidence new knowledge of, and interest in, non-flowering plants by setting up terrariums or fungariums, by growing ferns or mosses from spores, by making gill prints from mushroons or by learning to identify species of ferns, mosses or fungi.

THE TRIP:

This activity would best culminate a study of plant groups. If a pine plantation is used, comparison with a deciduous woodlot would be desirable.

Can you find examples of the different kinds of plant groups: flowering plants, ferns, mosses, fungi, lichens, algae?
Can you find plants that you cannot place in one of these groups?
Can you find clues and references that will give you some idea what the unknown plants are?
Which group is most numerous in the woods?
Which group is most numerous in the field?
Can you explain why some might be more numerous in one place than in another?
How many different flowering plants can you find?
How do you know they are all flowering plants?

Ferns

How can you tell one fern from another?
Compare the fronds. Are they all the same shade of green?
Can you find fronds that seem to be made up of smaller fronds?
Look at the backs of the fronds. Feel them. Do you notice anything that is not on the upper surface? Do all fronds have these dots? Do all ferns have them? Are they always in the same place on the fronds? Can you find a fern that has a leaflet that looks like a little stocking? What might be a good name for it? Can you suggest names for any other ferns based on your observations?

Mosses

How can you recognize moss?
Is there more than one kind of moss?
How many kinds of moss can you find? Describe the differences.
Can you suggest some names for some of the kinds of moss you find? Are the same kinds of moss growing in the field as in the woods? How does moss feel? (Compare with feel of lichens, algae.)
How does the ground feel where moss is growing?
How tall does moss grow? Measure the height of the tallest moss you can find. Find the shortest.

How does moss differ from ferns? from flowering plants?

Algae

Is that algae or moss on the trunks of the trees? How do you know? Is it true that it grows only on the north side of trees? (Which direction is north?)
Why do you suppose people say you can tell which way is north by the "moss on the trees" if it isn't true?
Why might more algae be found on the north side of trees than on the other sides?
What else can you investigate that would indicate whether your theory was correct?
How does algae differ from moss?
How does algae feel? Try to describe the feel. Compare with lichens, mosses.

Lichens

How do you recognize a lichen?
How do lichens feel? Compare them with mosses, algae. Try to describe the feel.
What color or colors would you use to describe lichens?
How many different lichens can you find?
Can you suggest names for some of them? Especially one with a red top - one that looks like this?

How does the ground feel where the lichens are growing? Compare with the feel of the ground where you find mosses, ferns.
Which plants do you think would be first affected by a lack of water? Algae, mosses or lichens? Why?

Fungi

How many kinds of fungi can you find? Feel them. How would you describe how they feel? Can you find fungi that have stripes or are pink? orange? brown? reddish? green? What does the green color of a plant usually mean? Do fungi contain chlorophyll? What might be the green coloring on some of the fungi? Why might algae be growing on fungi? Where are the fungi growing? What reasons can you think of for it to be growing where it is?

Feel the wood under the fungi. Try to describe how it feels, how it looks, how it sounds when you tap on it. Why does it have these characteristics?

Both fungi and algae were found growing on trees. Are both dependent plants? If not, why is the algae growing on the trees? Could algae grow on rocks?

ACTIVITY #29 Flower Function

MATERIALS NEEDED:

Hand lens, identification keys.

OBJECTIVES:

This field trip should contribute toward the student's understanding of the events that occur during the spring which lead to seed dispersal in the fall. The student should be able to:

Identify and differentiate between the buds of leaves and of flowers.
Name and describe two methods of pollination of flowers.
Identify the major parts of a flower that function in reproduction.

THE TRIP:

At the field and woods

Observation by sight and touch and smell.

Smell the air of the woods and field. Describe the odors.
Note, from a distance, the colors and abundance of leaves.
Look at the branches of trees and the stems of other plants.
Locate the leaves. Locate the buds if any.
Locate flowers on trees and other plants.

Smell the leaves and flowers of the same tree (or other plant). Do they have the same odor? Which do you think has the more pleasant odor, leaves or flowers? Do you think everyone would agree with you?

Look for plants that have buds but no flowers. Look for plants that have buds partially opened and/or fully opened.

Look for a leaf bud and a flower bud on a tree. Try to find the tiny leaves in a leaf bud. Describe them. Describe the differences between the two.

In the field, look for insects close to or in flowers. What insects do you see? Are they flying or crawling? Do they go to flowers of the same variety or of different varieties? Smell the flowers. Are the odors pleasing to you? Do you think it is the odor or some other factor that attracts the insects?

What part do these insects play in the story of seeds and their dispersal? Can you suggest other possibilities for pollination of flowers?

Can you predict the fall appearance of the plants you have observed?

ACTIVITY #30 Flowers

MATERIALS NEEDED:

Pencil, magnifying glass, mirror

OBJECTIVES:

Students should be able to:

Identify these parts of a flower: petals, sepals, pistil, stamens, anthers, bracts. Describe these in terms of color, number and shape.
Count the number of petals, sepals, and stamens and compare numbers.
Locate at least four types of flowers with varying numbers of component parts.
Distinguish monocots (plants with venation parallel) from dicots (plants with netted venation) and find two examples of each.
Define bilateral (two halves mirror images of each other) and radial symmetry (portions arranged similarly about a central point), and find at least two examples of each.

THE TRIP:

What parts of a flower are most brightly colored?
Find a flower with colored anthers. Find a flower with a colored pistil.
Find a flower with sepals. What color are they? Find a flower with bracts. What color are they? Find three flowers with colored petals.
Are there any lines or spots of darker intensity on the petals? Where? How are these spots or lines arranged? (Use a magnifying glass.)
What is the most common color for petals that you can find here today? What is the most common color for anthers? sepals? bracts? pistils? How many different colors appear in one flower?
Find the flower with the greatest number of colors. What parts are different colors?
What seems to be the average number of colors found in a single flower?

How are the flowers arranged on the plant? Are they in a terminal bud? in the leaf axils? on a separate flower stalk (scape)?
Are they arranged singly? in clusters? in a whorl? If in clusters, what type of cluster? raceme? umbel? spike? corymb?
Are the flowers produced on a stalk or are they sessile (attached to the plant stem without a stem of their own)?
Does the flower show radial symmetry or bilateral symmetry? Can you find any geometric shapes in the flowers or in the pattern of leaf arrangements? Do all the flower buds on this plant open at the same time? If not, can you determine a sequence by which this plant blooms? Do the leaves appear before the flower, after it, or at the same time? What makes you think this?

What shapes are the flowers you found? Can you find a flower that is bell-shaped? star-shaped? Can you find a flower that would catch rain in its cup? Did you find a flower that a bee might have difficulty entering? Can you find a flower in which the petals are united? Find a composite (a family in which plants produce several small flowers crowded together and arising from the same base). Try sketching some of the flowers. What names could you make up for the flowers you have seen?

Find at least 3 dicots. (Usually dicots produce flowers having structures in multiples of 4's or 5's.) Count the flower parts. Find at least 3 monocots. (Usually monocots produce flowers having structures in multiples of 3's.) Count the flower parts.

ACTIVITY #31 Stems and Budding

OBJECTIVES:

Given several tree branches, the student will be able to separate the branches with opposite buds from those with alternate buds.

Given descriptions of the buds, flowers, leaves, and bark of various trees, and a branch of each, the student will be able to match five branches to the correct description.

THE TRIP:

Have each member of the class examine five trees to determine the arrangement of buds on the branches. How many trees have buds which are opposite? How many alternate? Compare the bud arrangement with the branching system. Do the trees with opposite buds have opposite branching? Describe each kind of bark in terms of color and texture.

If the buds have not opened, examine them and compare them for size, shape, color. Describe them. Can you find some shaped like an onion? What other descriptive terms can you use?

If the buds have opened, describe the leaves or flowers. Be sure to mention texture and odor.

Describe each of the pre-selected five trees as to leaves, bud arrangement, flowers (if present), and bark characteristics. This can be done in the format of "I'm thinking of the tree which has_____. Which one is it?

ACTIVITY #32- TREE IDENTIFICATION

OBJECTIVES:

The student should:

Use the senses of sight, touch, and smell to discover several ways that trees differ, examining bark, fruit, leaves, twigs, leaf scars, and general conformation.

Recognize the kinds of areas where various trees are commonly found and the reasons for this.

THE TRIP:

Since trees spend a large portion of the year without leaves it is worthwhile to examine the other features carefully. It is best to have the entire group examine one tree together first if children are to be working in groups.

Look at the bark of the tree. Is it all one color or several colors? Does the surface appear ridged or flat? Feel it. Are the ridges hard or do they have a corky feeling? Are the ridges straight or intertwined? Are there any places where the bark appears to be peeling off? Is the bark the same color and texture on the branches and the trunk?

Find a twig. Is it the same color as the bark on the trunk? Does it have any spots or horizontal lines? Does it feel hairy or smooth? Are there any thorns? Is it slender or heavy? How flexible is the twig? (Twigs may also be examined for odor and pith by breaking them, but for obvious reasons this should not be done in an area which will be used frequently for tree identification.) Look at the arrangement of twigs. Are they opposite each other on the branch or do they alternate? If they seem to show both arrangements, look for a scar to indicate that a branch has broken off, making an opposite arrangement <u>appear</u> alternate.

Examine the terminal (end) buds for color, texture, and shape. Look at the protective scales covering the bud. How many are there? Are buds clustered at the tip of the branch or attached singly? Look at the lateral (side) buds. Find the scar just below each one where last year's leaf was attached. What shape is it? a triangle, a semi-circle, a circle, a clover-like shape? Find the bundle scars within the leaf scars (tiny dots which are the endings of the leaf's vascular (conducting) system). How many are there and how are they arranged?

Look for fruit attached to the tree or on the ground under it. Be careful to mention the agents that move seeds and berries around. (wind, water, animals and people) Be sure that the children don't leap to the conclusion that any tree with a pile of walnuts under it is a walnut tree. The general term "fruit" applies to any seed-bearing structure.

If leaves are present, are they simple or compound? What are the shapes and colors? Do they feel papery or leathery, rough or smooth ? Are there small hairs present on the surface? Does a small piece of the leaf have a distinctive odor when crushed? What is the venation? (pattern of vein arrangement) pinnate ? palmate? parallel? Are the edges of the leaf smooth or toothed? Is the leaf symmetrical or does it appear lop-sided?

Many tree guides do not mention the habitat areas where a particular species is found, but it is helpful to note this as an aid in recognizing the tree in the future. Is the tree growing on high or low ground? Is the soil well drained? Note the difference in growth patterns between two trees of the same species, one growing in the open and one in competition with other trees. Compare height to width in both examples. How far up do the first branches appear? Is the tree typically part of the understory of the forest, or does it grow large enough to become part of the canopy? If the tree being identified is a sapling, does it occur in an old field where there is much sunlight or in the shadow of taller trees? (Young trees in a field are likely to be light-tolerant species such as cherry, mulberry, ash or tulip, while young trees in a forest are more likely to be the shade-tolerant maples, oaks, and beeches.)

ACTIVITY #36 Conifers

OBJECTIVES:

Students should be able to describe the silhouette, needle arrangement, cones and other distinguishing characteristics of at least five evergreens.

THE TRIP:

How many different types of evergreens can you find today? Keep a record.

Can you recognize different species by their silhouettes? What are some of the distinguishing characteristics of shape?

Do the branches droop? curve upward? reach out straight? Is the top pointed? Is the tree tall and spire-like? fanlike? bushy? symmetrical? low and spreading?

What arrangement of needles or branches gives the tree its silhouette? If you cannot reach the branches, where else can you look? Are evergreen needles round? Can you find evergreens with flattened needles? with triangular needles? square needles? hook-like needles? curved needles? Are the needles sharp? dull? prickly? sticky? smooth? furry? fuzzy? What color are they? green, green with black? blue-green? yellowish? Do any have white lines or markings? How long are the needles? How many are in a cluster? (If they are in clusters, how are they held in the cluster?) What type of mark does the needle cluster leave on the branch when it falls off? Are the needles all around the branch or just on two sides of it?

Describe the needles of different evergreens you have found.

How long are the needles? Measure ten and find the average. Are all the needles on the tree living? How can you tell?

Can you find the last year's (the newest) growth? Does the tree have cones? On what part of the tree do they grow? How are they attached? How long are they? How wide? Describe their shape, appearance, color and texture. How many cones are in one cluster? Are there different kinds of cones on the same tree? Do all the cones seem to have formed this year? Can you find any on the ground? Are seeds still in them? If so, examine and describe the seed.

ACTIVITY #37 Insects and Plants

MATERIALS NEEDED:

Magnifying glasses and insect identification books.

OBJECTIVES:

Students should be able to locate at least five evidences of insect activity on plants.
In the days following the trip, additional student interest may be stimulated by encouraging students to find out more about the role of insects in the web of life, by carrying out further investigations, by doing research, or by choosing library books on insects.

THE TRIP:

What evidences can you find of insects using parts of plants for food? for shelter? for egg depositories?
What parts of the plants have been used?
Does the effect of the insect (or its eggs which become larvae) change the plant in any way? Does it enlarge a part of the leaf or stem? Does it destroy part of the plant?
What part?
Has this change affected the whole plant or a part of it?
Which do you think more damaging, eating a part of a leaf or boring a hole in the fruit, and from whose point of view? Is this true in all cases?

Has the insect used the plant as a foundation for making a cocoon, web, etc? In doing this has the insect changed the appearance of the plant? How?

Investigate any galls or other evidences of insect alterations on plants. (Example: foamy white bubbles. These are produced by an insect called a spittle bug. It sucks the juices from a plant stem and mixes them with air to make a bubbly mass in which the young are hidden.)
NOTE: Be sure to have children examine tree leaves carefully, especially oak leaves, for galls. Also, the stems of goldenrod are often infected with insect larvae which stimulate gall production. If there are cherry trees or witch-hazel bushes in the area, these are also good subjects for investigation.

Describe the gall or web or other evidence of insect-caused plant modification you have found. What is the shape? texture? size in relationship to a familiar object? Is it solid? Is it hollow? Does the insect appear to be within? What makes you think this? Can you suggest a name for this gall or for the insect that made it? Can you find any examples of insects which are helpful to plants? How is this insect beneficial to the plant? What makes you think this?

Have most of the insect activities you have observed today been beneficial to or harmful to the plants? Would man consider these activities beneficial or harmful? Why?

What would happen if DDT or another insecticide were sprayed here? Would this be good or bad? From whose point of view?

If an insecticide were used which was harmful to chewing insects only, but not harmful to insects which gather nectar from flowers, would this be all right to use? Why do you think so? (NOTE: If children seem to agree that this would be an acceptable insecticide, suggest that some of them do research on the life cycles of butterflies, such as the Monarch and Swallowtail.)

What would happen to the insects if man and all his insecticides disappeared from earth?
What would happen to the earth, the vegetation and other animals?

What would happen to man if all the insects disappeared?

ACTIVITY #39 Ants

MATERIALS NEEDED:

Hand lens, rulers calibrated to 1/16 of an inch or metric rulers, sugar, bits of hamburgers and crackers or bread, water.

THE TRIP:

How do you know that you've found an ant?
How is it like other insects? (3 sections to body, 3 pair of legs, antennae)
How is it different from other insects? (Encourage more than just a "no wings" answer).
Are all ants the same kind of ant? (Note: Some children may think that small ants are just baby large ants.)
How many kinds have you seen? (Children will probably recall "large black ants", "little black ants", and some may recall "medium-sized brown ants" and "tiny red or yellowish ants".)
Are all the ants around here (indicate general area or a specific nest) the same kind?
How big are the ants we see here now?
Are they all the same size?
What color are these ants? Are they all the same color?
Are they the same color all over?
What shape is the head? the thorax? the abdomen?
Which part is the largest? the smallest?
Are all the legs the same length? How many joints in each leg? Do the joints bend forward like your knee, or backward like your elbow?
Can you see the mouth?
Can you see the eyes? Does an ant have eyes? Does an ant use sight to guide it as it moves, or does it use some other sense?
How could you find out?

What happens if you put a stick in front of a traveling ant? Pick it up and shake the ant off, or put the ant down in some other place heading in some direction other than the one in which it was traveling. (Give time for experimentation and observation. Discuss findings.)

Suppose you turn the ant around and head it back in the direction from which it was coming. Does the ant appear confused? (What makes you say this?) Does it appear to be searching for something? (Why do you say yes or no?) Can it re-orient itself to go in the "correct" direction? How far from the original path can you put an ant and still observe it re-orient? Does it re-orient more quickly if it is placed (in reverse position) on the trail, or to the side of its trail? What happens if you pour water on the path in front of an ant that has been traveling in a definite direction? What happens if you brush away the dirt from a path on which the ant is traveling? What happens if you drop some sugar or some meat to the side of or behind an ant that is traveling in another direction? Experiment with dropping the sugar or meat a foot away, 2 feet, 3 feet, etc. How far away can you drop it and get a reaction?

Do ants respond more quickly to sugar, meat, or cracker crumbs? Do all ants respond equally to the same stimulus, or do they have food likes and dislikes as you do?
How fast can an ant travel?
How far does it go in 15 seconds?
At this rate how far could it go in 1 minute? 1 hour?
Taking into account their sizes, which travel faster, large ants or small? Does a small ant, half as long as a large ant, go half as fast?

Choose 1 ant and follow it for 5 or 10 minutes (depending on time and maturity of group). Where does it go? What does it do?

What happens when two ants meet? (Describe in detail. Observe after putting sugar near one of them.) Do you think they are communicating? Why? If so, how?

How does an ant travel through grass? across muddy soil?
Does an ant leave a trail in dust? in mud?
Where do you find the most ants? under trees? in grassy areas?
Are there more ants in damp places or in dry places?
Are there more ants in clay soil, sandy soil, or humus?
Are the same kinds of ants found under trees as under other plants?
Are the same kinds of ants found in clay soil as in sandy soil? as in humus?
Where do you find ant nests? out in the open? in the grass? under leaf piles? under rocks or logs? Of what is an ant nest made? How do you recognize it? Do all ants build the same kind of nest?

SOME FACTS ABOUT ANTS:

Ants have combs on their front legs. They have tongues.
They feed their queens and babies with the tips of their tongues.
Ants touch antennae to friends and fight foes with jaws and a spray of acid.
Ants feel shadows, drink dew, and carry water. (Try to design investigations to illustrate and observe these points.)
Ants keep their nests clean.
Ants move their young according to the dryness, dampness, and warmth of the rooms in their colony.
Ants help the soil by burying bits of organic material.
Ants are found all over the U.S., but kinds differ.
Some ants make summer nests and different winter nests.
Some ants keep herds of aphids (ant cows) for the "honey dew" the aphids excrete.

ACTIVITY #40 Insects

OBJECTIVES:

After this field experience, a student should be able to list various places where insects can be found and write a paragraph pointing out why insects cannot be classed as either "bad" or "good".

THE TRIP:

Would you expect to find many insects here? Why?
Do you expect to find more flying or non-flying insects?
Is an insect an animal? (yes)
If you found a small animal, how could you tell that it is or is not an insect? (Insects have three major body divisions and six legs.)
Are there any bees in this area?
Can you find any evidence of hive-making?

Where would you expect to find insects? (Allow time for speculation before directing observation.)
Are there any insects in the leaf-litter?
Are there any insects in the crevices of tree trunks?
Did you find any cocoons? (If so, describe them. If not, can you guess why not?)
What will come out of the cocoon later? How much later?
Did you find any soil-dwelling insects?
Did you find the dwelling itself?

How many insects can you find in a circle 3 feet in diameter?
How many flying insects can you find? How many soil-dwelling insects can you find? Which seem to be more numerous?
What is the average length of the insects that you found?
How long is the longest insect? How short is the shortest insect?

How might insects be helpful to plants? to animals?
How might insects be harmful to plants? to animals?
Are insects "good" or "bad"? Are all insects either bad or good?
Should we bring some "bug spray" on our next trip? Why?
If we spray the insects, will the spraying hurt any other animals? What animals? Why do you think this? If we removed all the plants from this area, what would happen to the insects? If we removed all of the insects, what would happen to this area?

ACTIVITY #41 Listening to and Looking at Insects

MATERIALS NEEDED:

Thermometer, stop watch, clear plastic or glass containers for observation, reference books on insects.

OBJECTIVES:

Children should be able to:

Determine how many times a given phenomenon occurs within a given length of time.
Describe the appearance of insects observed,noting characteristics which seem applicable to a number of species and noting characteristics which, while often associated with insects, are not shared by all species.
Pick out at least three sounds made by insects, differentiating them either by identifying the insects making them, or by describing them with appropriate adjectives.

In the days following the trip, observe your students to determine if they demonstrate a loss of previous dislike or fear of insects by bringing in specimens for observation or study, by displaying a willingness to handle or observe specimens brought by others, or by voluntarily pursuing one of the suggested follow-up activities.

THE TRIP:

What is the most obvious sign that insects are all around you? (Answers will vary: hearing them, feeling them biting!, etc.)

Listen for the sounds of insects.
Can you pick out one of the sounds and find the insect that is making the sound?
What happens when you approach the insect? Why do you think this happens? If you stay still and quiet, will the insect make his sound again?
Can you find out how the insect makes the sound you heard?

Do you hear any insect sounds from farther away?
Does the sound seem to be made by one insect or by several insects? What makes you think so?
Can you use words to describe the sounds of insects? Which ones are repetitive? buzzing? clicking?
Can you make up words that go with the sound? (Such as "Katy-did, Katy-didn't")

What do you hear when insects fly around you?
What part of a bee makes the buzz?
Do all insects sound alike when they fly?
Can you think of words to describe the sounds various insects make flying?

You can tell the temperature by the chirp of the snowy tree cricket (Oecanthus niveous). Count the number of times a cricket chirps in fourteen seconds. Add 40. This will give the Fahrenheit temperature. All crickets chirp more rapidly when it is warmer. (Does the same formula for finding the temperature based on the number of times per minute apply also to field cricket chirps?)

Look for insects. Where would you look? (Allow time for suggestions, and then for some investigations.)
Did you find insects where you expected to?

How do the insects you found move? Do they fly? crawl? hop?
Are their legs all the same size? Does this seem to have any relationship with the way they move? How many legs does the insect have? To which of the three body segments of insects are the legs attached? the wings (if you can find wings)?

How many eyes does the insect appear to have? What is the proportionate size of the eyes to the rest of the head? The rest of the body? How does this compare with your eyes and your head? Look at the insect's mouth. Does it have a mouth adapted for chewing? for sucking? for something else? What do you see that makes you think this? Does the insect have a tongue? Where is it? Try to describe it. Does the insect you found have antennae? Does it have wings? How many? Can you find any insects that don't seem to have wings? Do all grasshoppers have wings? Do all winged insects have the same number of wings?

Can you find a grasshopper? a cricket? What colors do you see?
Can you find an insect with spots? stripes?
Can you find an insect that is one color all over?
How many different color combinations can you find on insects?
Does the color of the insect seem to have any relationship to the place where you found it?
Can you find an insect which is camouflaged by color?

Rope off an area about one foot square. Try counting the number of insects in that area. About how many do you think there are in the whole field?

What will become of these insects during the winter? How can you find out?
How do you think this species will survive till next spring?
Can you find egg cases or signs of insect homes?

ACTIVITY #42 Spiders

MATERIALS NEEDED:

Hand lens
Field guide on spiders

How do you know you've found a spider?
How many legs does a spider have?
How many sections does a spider body have?
Is a spider an insect?
How many legs does an insect have?
How many sections does an insect body have?
Do spiders have antennae?
Did you ever see a spider with wings? (Caution on last question! Some children have seen everything!)
(NOTE: If children have not previously studied insects, and have had little experience with spiders, these questions may constitute the basis of the entire trip, rather than just an introductory survey and review. In that case, all small creeping, crawling, hopping, flying, buzzing and biting (!?) things should be examined for number of body sections, number of legs, and various haves and have nots, such as antennae, wings (not all insects have them), and silk-like web or dragline production (although some insects, such as caterpillars, produce silk at various stages in their life cycles). The animals found and examined for these characteristics could then be classified into three groups: insects - those having 6 legs, and 3 body sections; spiders - having 8 legs,* 2 body sections, and abdominal spinnarets (silk glands); and others - those having more or fewer than 8 or 6 legs, respectively, and having no abdominal spinnarets.

*Not all 8-legged creatures are spiders, however. Harvestmen (daddy long-legs) are not. Neither are ticks, mites or scorpions.

Spiders

Spiders have 4 pairs of legs, attached to the cephalothorax.
The cephalothorax is the combination head-thorax.
The spider has 2 body sections, cephalothorax and abdomen, which are joined by a thin stalk, the pedicel.
The cephalothorax contains the brain, stomach, and poison glands.
The abdomen contains the heart, digestive tract, reproductive organs, and spinnerets (silk glands, usually 6 in number).
Through the pedicel pass the nerve cord, the aorta, and the intestines.
Like other arthropods, the spider has jointed legs which terminate in 2 or 3 claws.
Also, like other arthropods, spiders molt as they grow.
Children might look for the empty exoskeleton of a spider.

Observing Spiders

To what part of the spider's body are the legs attached?
Are the legs jointed or unjointed?
Does a spider have claws? suction discs? How many?
Are the legs smooth or hairy?
Is the rest of the spider smooth or hairy? Is it sticky?
Does it feel moist? dry? warm? cold?

How are the cephalothorax and abdomen joined?
What color is the cephalothorax? the abdomen? the legs?
Is the spider the same color on the underside as on the top-side?
Are there any special markings which might suggest a name for this spider?
Does the spider blend with or contrast with the background?
(Is the background its usual environment?)

Is the cephalothorax larger than, smaller than, or the same size as the abdomen?
Is the abdomen rounded? pointed?
Are the legs longer than, shorter than, or the same length as the body parts?
Are all the legs the same length?
Is the over-all appearance of this spider longer than it is wide, wider than it is long, equal in length and width?

Does the spider have eyes? Where? How many? How large are they compared to the rest of the cephalothorax? Do they seem to be compound eyes like an insect's?

How does it breathe? Can you find nostrils? spiracles ?
(NOTE: If children have studied insects, they should know to look for spiracles (breathing holes) in the sides.)

What is the over-all size of this spider? (Record this, and

then look for other spiders of the same type. Use differences in size to make observations and inferences about males and females and spider growth.)

How does this spider move? Does it run, hop, and/or jump?
Does it move forward? backward? Can it move in all these directions?
Does it pick up more than one foot at a time? and does it move them at the same time or one after the other? Does it move alternate feet or opposite feet? Are all the feet used in moving?

Look for a spider on its dragline. (NOTE: A dragline is the single thread by which spiders often descend.)
When a spider is descending on its dragline, does it hold on with any of its legs?
Can a spider go back up its dragline? If so, what does it do with the silk below it? Do you think the spider eats the silk? dissolves it with some chemical? winds it up for later use? Is the silk elastic like a rubber band?
When the spider is going back up the dragline, how many legs does it use?
Can the spider move the line or must it drop straight down?
What happens if the wind is blowing? (Be a wind and blow gently on the dragline. What happens?) If there is no wind blowing, how can the spider make horizontal threads to spin a web? (This may take follow-up investigation!)

Look for a spider in its web, or using a horizontal dragline.
How does it move?
Does it travel rightside up or upside down? forward or backward?
Does it use all its legs?
How does it avoid getting caught in the web (like some insects may be observed caught in it)? Did you just guess this answer, or did you observe something that made you think this?

Observing a non-web-spinning spider

Look carefully at the flowers of goldenrod, Queen Ann's lace, milfoil, or even a garden species such as zinnia. You may see a small, light-colored spider with long front legs.
The "crab spider" is lying in wait for a meal.
How do you suppose this spider catches food?
Is the web nearby? (Better not ask this if the web of another species is near at hand!)
How does the spider's color blend with its background?
Does it appear to see you? What makes you think so?

Try to find an ant or other small insect to place on the flower near the spider. Observe what happens.
How did the spider catch the insect?
Can the crab spider change color like the chameleon?
Look for spiders which mimic ants.
Look for female wolf spiders carrying egg cases or carrying their young on their backs. (Wolf spiders will most frequently be found near the outside foundations of buildings.)

ACTIVITY #43 Spider Webs

MATERIALS NEEDED:

Hand lenses, jars, microscope, field guide (if identification of spiders is desired)

OBJECTIVES:

Observation skills should be strengthened after completion of this activity.

THE TRIP:

Ask: Do you"like" spiders?
In what ways are spiders valuable to man? (They eat many insects, some of which are harmful according to man's value system.)
Can you think of other animals that eat insects? (parasitic and predatory insects, insectivorous birds and mammals) Ask students to describe the spiders they find.

Find a spider web and examine it carefully. (Early morning, with the dew covering everything, is a good time to spot webs. The dew-covered silk strands are very noticeable.) Spiders produce several kinds of silk which are used in different ways:
(Note, however, that all spiders do not spin all of these different types of silk.)

1. The dragline which they spin as they move about, used to lower themselves from an elevated spot and also to form the permanent frame of their webs.

2. A viscid sort of silk with which they entrap their victims.

3. A silk with which they swathe their victims.

4. A thick, often brightly colored silk that they use for wrapping their eggs.

5. Ballooning lines (long lengths of silk produced by young spiders) that catch the wind, used as a means of spider dispersal.

Ask: If you have located an orb (cartwheel) web, do the silk strands stretch? (Silk may be stretched an additional 1/4 of its length before breaking.) Does the web appear to have different kinds of silk lines in it? Look at the "spokes" of the web. Touch them gently. Look at the spiral lines of the web. Touch them gently. Is there any difference? Use a hand lens to inspect more closely the lines of the web. Can you see any difference in the silk? Were different types of silk used?

Perhaps a microscope could be used to study a small strand of silk saved from the web. Observe the differences, if any, in the strands taken from different parts of the web.

Construction of Webs

1. Domestic or house spiders - merely a maze of threads extending in all directions without any observable pattern (cobwebs).

2. Closely woven sheets on a single plane with threads extending in all directions without regard to pattern - this snare is made by the hammock spider.

3. Funnel-shaped web of the grass spider.

4. Orb web of the garden spider.

Ask: Does the spider stay near his web?
Do you see him anywhere?
Is this web old or new?
Perhaps it has been abandoned. Look for the spider. (The funnel-shaped webs have a tube extending downward at one side. The tube is used by the spider as a hideout in which it lies in wait for its prey, or as a place of refuge in time of danger.
Can the spider escape from the tunnel any other way than the front of the tube? (The tube is open at both ends so that the spider can escape by the back door, if necessary.)

If you touch the web lightly perhaps you will see the spider spring out from its hiding place to seize its victim.

Can you think of the uses to which the spider puts his web?

1. snares (primary function)
2. shelter
3. supports for egg sacs
4. nests for the young
5. dispersal of young

How do spiders know victims have been trapped in their webs? (Some spiders spin trap-lines from the webs to their dens, and the lines vibrate when insects have been trapped.)

What does the spider do when a victim is trapped in its web? (Observe the actions of a spider when a grasshopper has been tossed into the web.)

The moment an insect is caught, the spider rushes toward it, wraps it in a band of silk (swathing band), and rolls it over and over.

Do all spiders spin webs? (No)

1. Crab spiders lie in wait for their prey.
2. Wolf spiders chase their victims over the ground.
3. Jumping spiders are also hunters.

Use a field guide to help the children identify the spiders.

ACTIVITY #46 Spider Webs

Have you ever run into a spider's web?
How would you describe it?
How was it similar to a piece of thread? How different?
Was it easy to brush off?

(Note: Spider silk stretches up to one-fourth of its length. One species of spider produces the strongest natural fiber now known, but spiders are not raised to produce commercial silk. (Why might this be?)
Spider silk is a protein, which comes from the spider in liquid form and hardens immediately.
Not all silk produced by one spider is the same. Some is sticky and is used to make the trap lines in the web. Some is non-sticky and is used to make the foundation lines. Some is used to form egg sacs, and some, to wrap the spider's prey.
A spider generally has 6 silk glands. In some species the sticky coating for the trap lines is applied to a non-sticky thread, almost simultaneously with the production of the non-sticky type.
A "single" strand of spider silk may actually be a several-ply strand, woven as the several glands produce a filament.

Observing Spider Webs

What shape is the web?
Would you describe it as being more like a bicycle wheel, a lace doily, a kitchen sieve, or a trampoline net? Is it shaped like a wheel, a funnel, a dropped handkerchief?

(Note: Some children may think all spider webs were originally the spoke-like orbs of the garden spider and have collapsed into the more or less unpatterned maze of the funnel weavers. This activity should lead them to observe that different species of spiders spin different kinds of webs, just as different species of birds build different kinds of nests. The most common are the orb webs and the sheet webs. The sheet web has many variations, such as the dome web, a "pie-slice-piece of orb web", and the scaffold web, which is the common house-spider's mesh web.

Is the web 2-dimensional or 3-dimensional?
Are there distinct threads that you can follow, or are the threads so closely woven that you can't see individual threads or space between them?

Can you see through the web?
Is it transparent (like window glass)?
Is it translucent (like wax paper)?
Is it opaque (like construction paper)?
Can you see the individual threads? Are they parallel?
What sorts of angles are formed where the threads cross?
What seems to be the general construction of the web?
Look for foundation lines which attach the web to something solid. To what are they attached?
Look for radii, which cross the foundation lines. Are they parallel? To what are they attached?
Can you find a trapline (the thread leading from the web to the spider's hiding place)?

If you are examining the web of the garden spider (Argiope), look for the stabilimentum, a zigzag band extending from the center downward, or possibly from the center upward, or in both directions.
Is it a single band, a double one or is it even more complicated?

(Note: The familiar garden spider's web, the symbolic cartwheel, is actually composed of 4 kinds of silk: the non-sticky strong foundation lines, the radial lines, a hub in the center where the spider sometimes rests, and the sticky spiral snare lines.)

Is it easy to see the web? Is it easier to see it from one position or angle of sight than from another? Do you think an insect would be likely to see this web? From what angle would it be least visible? (Note: Webs are much easier to see in the early morning, on a foggy day, or just after a light rain. Why?)
How long do you think this web has been here?
Is it in "perfect" condition?
Are there holes in it? (What might have made them?)
Is there dust or dirt in it?

(Note: Webs are fragile and are easily damaged by struggling insects or by large animals passing through. The sticky threads of the trap collect dust and become less sticky with passing time. An orb weaver can spin a new web in a few hours. Although we do not encourage children to break a spider's web deliberately, if this happens accidentally at the beginning of the trip, plan to revisit the spot at the end of the trip to look for repairs that have been made.

Better yet, stay and watch the spider rebuild. Watch for the spider to make the sticky part. After pulling the trap thread taut, the spider plucks it, like a guitar string. This causes the glue to collect in droplets along the thread. It is stickier this way.)

Why do you think spiders spin webs?
Is the spider in the web?
If not, why do you think not?
Is the web the spider's home or simply its trap?
Is anything caught in the trap?
Can we find the spider nearby?
What might attract him to make an appearance?
(Note: Funnel-web spiders are frequently lurking inside the narrower part of the funnel, waiting to dash out and capture any victim. Try dropping various items (seeds, ants, grasshoppers, cookie crumbs) on the "porch" of the funnel. Does the spider come out? Does it take the food? Do you think the spider saw the food? smelled it? was attracted by the vibrations of the web? How might you find out through further investigations? How many times will the same spider dash out to a false alarm?
Is anything else in the web?

Draglines

Look for a spider suspended from a single thread (called a dragline).
Was the thread already there, or is the spider spinning it?
Is the thread vertical, horizontal, or at an angle?
Is the dragline sticky or just "cling-y"?

ACTIVITY #47 Earthworms

MATERIALS NEEDED:

Hand lens (10x), flashlight, rulers divided to 1/16 of an inch or metric rulers, soil pH kit, watch with second hand.

I. Where do you find earthworms?
Are they on the surface of the soil or deeper down?

Are they more numerous in the field or woods?

Are they more numerous where there are many plants or where there are few plants?

Are they more numerous where there are leaves and debris on the forest floor or where there isn't much debris?

Are they more numerous where the soil is wet, as in a marshy area, or where the soil is very dry, or where the soil is moderately damp? (Note: Be sure to allow for recent weather conditions.)

Are they more numerous in soil that is well-drained or in poorly drained soil? (Note: This question may require some explanation.)

Are they more numerous where the soil is stony or not stony?

Are they more numerous where the soil is matted with roots or where it is more root-free?

Are they more numerous in sandy soil, clay soil, or humus?

Are they more numerous in acid soil, alkaline soil, or neutral soil?

II. How big are earthworms? (Note: There is an Australian earthworm that grows up to 11 feet long and weighs 1 1/2 pounds.)
Measure the largest worm you can find.
Measure the shortest worm you can find.
Measure a dozen worms and find the average length.
Does the size of the worms vary with their habitat?
If so, how? Where do you find the largest? the smallest?
Does the size of the worms vary with the number of worms in a given area? If so, how? Do worms grow larger where they are fewer?

in number or more numerous? Can you offer some explanation for this? (A possible explanation could include that worms grow larger where there is not so much competition from other worms, or that conditions not favorable to earthworms limit growth as well as number.)

How many segments does the longest worm have? the shortest? What is the average number? (Note: Earthworms belong to a group of invertebrates known as annelids (segmented worms).

How far can the longest earthworm extend itself? How much can it contract? What is the difference between minimum and maximum lengths?
Measure the maximum and minimum lengths of other worms. Is there a ratio between maximum and minimum lengths? Can a worm contract (or extend) both ends equally? How does a worm contract and extend? Is it like an accordion? like a rubber band? like a telescope? Does it get thinner as it extends and fatter as it contracts?

How large is a worm in diameter?
Is it the same size all over?
Where does it reach its maximum diameter (how many segments from the front)?
Does it taper equally at both ends? If not, at which end does it taper more, head or tail? (Note: It may take time to determine which is the head and which the tail.
See questions in Section III of this activity.)

Is there a ratio between diameter and length?

Is there a relationship between diameter and environment?

Is there a relationship between diameter and population?

III. Which is the head and which the tail, or can both ends serve as a head?

How would you go about determining if a certain end was the head?
(Suggestions may include offering food to both ends and seeing if one responds more readily; shining a flashlight beam at alternate ends; touching ends to see which responds more; watching which way the worm travels, then picking it up, turning it around, and observing which way it travels.
Actually, the head end is the fatter, rounder end. The tail is usually more tapering. The head is called the anterior and the tail the posterior. There is a mouth slit in the head.)

(Note: Some worms will be found with a mucous band near one end. This is an egg case. Worms are bi-sexual and cross-fertilize. When the egg case is filled with fertilized eggs it moves toward the front end of the worm's body, and then off over its head. The mucous case then serves as a "cocoon" in which the eggs develop.)

IV. Does an earthworm travel toward or away from light? (Are you sure it is reacting to the light? Might it be reacting to something else - such as the heat from the flashlight beam?)
Do you think an earthworm can see? Why do you think this? (Note: Earthworms are light-sensitive. They have no eyes, but they have specialized cells that can tell the difference between light and dark.)
Do you think an earthworm can hear? Why?
Do you think an earthworm reacts to vibrations? (Note: Earthworms cannot hear, but they do feel vibrations.)

Does an earthworm have a top side and bottom side?
Turn the worm over. Does it appear to right itself? Try this with other worms.
Examine the worm. Does one side appear to be more flattened? (Note: Earthworms have a dorsal (upper) and ventral (lower) side.)

How does an earthworm move?
Examine a worm under magnification. Bristle-like projections should be observed on the ventral surface.
Does the worm move more easily on a rough or smooth surface?
Does the worm move all or just part of its body at one time?
Is any part of its body off the ground while it is moving?
Does it move forward only? forward and backward? sideways?
Does it travel in a straight line? How straight?
Describe the movement of an earthworm. (Note: Can you imitate it?)
Does it move and then stop (or rest), or does it move continually?
How far can an earthworm travel in one minute?
Measure the travels of several worms in a given amount of time.
Compare the distances traveled with the length of the worms. Can you find a ratio that is fairly constant? (Can a worm travel 10 times its length in one minute?)
At this rate how far could one worm travel in one hour?
How does this compare with a tortoise? a man?

V. Describe an earthworm.

Is it the same color all over?
What colors can you see? Are these colors on the worm's body, or is the worm somewhat irridescent?
Are all earthworms the same color?
If not, is there some relationship between color and habitat? Is there some relationship between color and size?
Can you see blood vessels? (Note: If you observe closely you can see the dorsal blood vessel contracting.)

How does an earthworm feel?
What makes it have a slimy feeling?
Does the worm leave a track like a garden slug?
Is it covered with skin? scales? a soft or hard outer covering? (What does this tell you about its classification?)
(Note: Earthworms breathe through their skins, and if the skins dry out, they suffocate. Thus care should be exercised in <u>not</u> handling them too much. Gases and chemicals dissolve on the moist skin, producing sensations of smell and taste.)

<u>Worm Castings</u>

Look for small mounds of earth (particularly visible in early morning near the openings of worm burrows). Earthworms eat their way through the soil, and while vegetable matter in the soil is digested and assimilated, the soil is excreted. It has been estimated that earthworms add 1 1/2 inches of soil to the surface of the earth each year, or about 180 tons per acre. Worms have a gizzard and ingest small particles of sand or gravel which are used (as in chickens) to grind food into smaller pieces to facilitate digestion.

ACTIVITY #49 Birds

MATERIALS NEEDED:

Pencils, paper

OBJECTIVES:

Students should be able to:

Give several evidences demonstrating that birds are present in a given environment.
Describe several different habitats used by birds.
Tell what attracts birds in each habitat.
Name several birds found in each of these habitats.
Describe several changes which can occur within a habitat, explaining the effects of such changes on bird life. They should be able to tell which of these changes they observed on the trip and what part man played in such changes. They should be able to predict the results of such man-made changes as blacktopping, cutting down trees, using pesticides, mowing and planting a hedgerow.
Differentiate several birds by song or call.
Be able to describe the field marks of several birds seen.
These field marks should include flight pattern and/or walk, song, distinguishing shape and/or colors. Upon referral to field guides they should be able to name these birds.

Given the silhouettes of several birds seen on the trip, and their names on another list, students should be able to match several names and silhouettes.

In the weeks following the trip, student interest in birds may be encouraged by their reporting, informally or formally, to the class or the teacher about birds seen in their home or school neighborhoods. Some might report the development of bird habitats around their homes or suggest ways of accomplishing this around their school grounds.

PRE-TRIP:

Listen to bird calls on records and look at bird pictures. Note color and silhouette of birds both perched and flying.

THE TRIP:

Suggested questions to guide pupil discoveries.

What sounds do you hear that tell you there are birds present?
Are any of these bird calls familiar to you?
Where do the bird sounds seem to be coming from?
Are the same bird sounds coming from all directions?
Is the habitat different in the areas where you hear differing sounds?
Are the birds singing or are they uttering call notes?

Do you see any signs of birds? Where?
What do the birds you see seem to be doing?

Do all birds move the same way? Do you see any that seem to walk? to hop? to waddle? Do they fly in a straight line, an up and down pattern? Do they flit around in the branches, move up and down the trunk?
Watch for ones that move in different ways and try to describe how they move.
How are the movements of the birds associated with their activities?

Do you see any signs that indicate birds are here, even though you may not see them?

What do birds need (at this time of year)?
How are these needs being met by this environment?
Has man contributed to making this an environment usable by birds? (if applicable)
Has man changed this environment in any way?
How might these changes have affected the (kinds of) (numbers of) birds here?
(NOTE: It may be necessary to call attention to certain types of plants, to the amount of cover, to recent evidences of mowing, to buildings.)

How would this habitat be changed if:
The grass were mowed - not mowed
A large area were blacktopped
Certain trees or shrubs were cut
The buildings were torn down
The area were sprayed with DDT or other pesticides to reduce the number of insects.
Would these changes help or harm the birds?
Would you expect to find birds here at other seasons? Why?

ACTIVITY #50 Hearing and Describing Birds

MATERIALS NEEDED:

Field guide to birds; paper and pencil

OBJECTIVES:

Children should be able to:

Describe or imitate three different sounds made by birds.
Name the two senses most useful in bird observation.
Describe two precautions to be taken to ensure bird observation.
List five general field characteristics helpful in bird identification.
Identify at least five birds (pictures) by use of a field guide.
Make a list of at least ten adjectives describing bird activity and behavior.

THE TRIP:

Are all the sounds you hear made by birds? How can you tell?
Could you tell better if you could see them?
What are some of the sounds you hear which are not made by birds?
Do all the sounds have the same quality? (Pick out some and try to describe them. Try to express them in words or sounds that you make.)
Do you think each sound is from a different kind of bird?
Why do you think this? Would you consider all these sounds made by birds to be bird songs?
Are all the bird sounds you hear made the same way? Do birds have voices similar to those of humans? Explain your answer. How else might they make noise except by the use of their voices?
Can you hear sounds that might indicate birds are making noises in different ways?
Can you see all the birds that you can hear?
When you do see a bird, what problems do you have in observing it?
Can you pick out colors or marks on the bird? Describe them.
What shape is the bird? Try to draw it in outline and put in the marks you may have seen. Compare your drawing to one in a field guide you may have available.

How many legs does the bird have? Describe them, if possible.
Does a bird have arms? If not, how does he pick things up? What is the general shape of the bird's bill? Draw it.
How does he use his bill?
What is the bird doing? Describe how he does it. How does he fly?
Is there a pattern to the flight?
How does he hold his wings? How does he move his wings and tail?
How does he sit on a branch? How does he move on a tree?

What adjectives can you think of which would describe the bird and his movements? Make a list. Now read your list and make sure it describes what you really saw when you looked at the bird, not what you thought about it.
What things can you find that might show that birds have been here? (Nests, woodpecker holes, etc.)

ACTIVITY #51 Field Study of Birds

MATERIALS NEEDED:

Pencil, paper for sketching and making notes, binoculars.

OBJECTIVES:

Students should demonstrate ability to take notes on field observations and to organize these, with information gained from reading and other observations, into an oral or written report. The report should show that the student has observed the bird's characteristic movements, song, feeding habits and preferred habitat.

THE TRIP: "

For each bird observed answer the following questions:

Does this bird spend most of the time in flight, flitting around in trees, on the ground? What is he doing in his activity? Where is he most frequently, at the top of tall trees, in the understory or shrub layer, or on the ground?

How does he move on the ground, by walking or hopping? When flying does he flap his wings, glide, or soar? How does he hold his tail? Are his wing movements regular or irregular, fast or slow? How does he hold his head? At What angle does he perch? Where does he perch?

Does the bird seem to be raising young? If so, where is the nest? What is its shape and size? What is the nesting material? What sort of activity is going on there? Can you hear any baby birds? Do both parents share in nesting responsibilities?

What does the bird look like (color, distinctive markings, shape, beak)? Does his color blend with his environment? What is his size compared with a robin, house sparrow and crow? Are male and female colored alike? What is his silhouette? How could you recognize him with the sun behind him or when he is in flight?

Draw his silhouettes, perched and flying. Imitate his walk. Sketch him in characteristic movements.

Include background in sketches to show habitat. What does he seem to be eating? Is his diet mostly grains, fruits, insects or ground-dwelling worms and grubs?

Is his choice of food likely to conflict with man's choices? Is he beneficial or a pest to man? to other things? With what other birds does he compete for food in this habitat? Does he seem to have any enemies? Does he pick on any other kinds of birds or animals?

What is his call? his song? Is it loud? soft? musical? harsh? Does he have an alarm note? What alarms him? Does he seem to have certain perching and singing areas? Could you put his call into words? Would you expect to find this kind of bird near your school? your home? Why?

ACTIVITY#52-Birds: Observing Habitat and Anatomy

MATERIALS NEEDED:

Binoculars, field guide to birds (suggest Peterson)

OBJECTIVES:

Upon completion of this field trip participants should be able to:

Name the two senses most useful in bird observation.
Compare three habitats of birds with some reference to the birds found in each.
List five general field characteristics helpful in bird identification.
Estimate, within a few inches, the size of a bird or other object of similar size at 20 yards distance.

THE TRIP:

As classroom work related to this field trip, it is assumed some familiarity with common birds and bird types has been attained by the students. A discussion of migration both before and after the trip would be invaluable, as during the fall months most birds are traveling to their wintering grounds. It would be interesting to try to project which types go on south and which would winter in this area. Even further, are those birds who winter here the same individuals who nest here or are they others of the same varieties who have migrated from elsewhere? You might speculate on methods that could be used in finding out. (Bear in mind that most birds are protected and may not be captured or marked without federal license.)

Walk out from the starting point to a convenient area of "edge"- the brushy area between woods and meadow - or any area of low trees and bushy spots where birds could be expected to find shelter and food. Available water is also attractive to birds. On the way, a discussion of the habitat of various birds might be helpful.

Where might we expect to find birds?
What signs would you expect to find that indicate there are birds in a given area?
Would you expect to find ducks in this area? Why or why not?
Would you expect to find hawks, owls, condors, ostriches, etc.?
Name some of the birds you would expect to find.
Describe the places where you think these birds might live.
What conditions do birds need for a comfortable life?
Does this area meet those conditions?
What are some of the reasons you might not find the birds you expect to find?

(Do not try to find as many birds as you can as fast as you can, but rather find a few which may be easily observed and watch them closely. Sometimes in fall migration, small birds exhibit marked curiosity and may approach the observers closely if they are patient and do not make sudden moves or loud noises.)

Look carefully and quietly at the bird. What color is it? Is it all the same color, or is it streaky, blotchy, etc.? What size is it? Try to base size on a comparison to known birds; i.e., crow size - 20", robin size 10", sparrow size 6".

How far away from you is it? This might be checked roughly after the bird has flown.
Can you see any obvious distinguishing features? Look especially for color patches, wing bars, eye lines.
What simple descriptive words could you apply to the shape of the bird? (Thin, fat, chunky, etc.)

Look now for the bird's bill. What is the general shape of the bill? (Draw it geometrically.) To what tool which you have used might you compare this bird's bill? How is the bird using his bill? What clues do you find in the shape of the bird's bill which might tell you about his food habits? What other uses has the bill? How does a bird chew his food? (This may need further research.)

Can you see the bird's feet? How many toes does the bird have and how are they arranged? (This will be difficult to observe but you might look for tracks in soft mud and then ask: How do we know these are bird tracks?)

How does the bird use his feet? How do his feet compare with your feet or hands? (Think about this one: How do perching birds sleep while perching? Could you sleep while your fingers held your weight on a branch?)

Observe the bird's movements and describe them. Do you notice any pattern to the bird's movements? Does he do anything that appears unusual to you? (Cling to the bark of the tree, hang upside down, fly out and return to the same perch, etc.)

What noises does he make?
(Try to imitate them or put them into words.)
(Birds are not as likely to sing in the fall as they are in the spring, but careful listening may lead you to many birds.)
Try to observe birds in deep woods and open fields and compare the various places as bird habitats. What types of birds are found in each?

ACTIVITY #53 Animal Traces in Wooded Areas

MATERIALS NEEDED:

Paper and pencil, hand lens, binoculars, ropes of string (1 yd.), keys for identification.

OBJECTIVES:

After completion of this field trip, the student should be able to:

Use skills developed in the classroom in the direct observation of animal traces found in a natural environment.

Support all inferences made in regard to animal traces with logical reasoning based on his observations.

Identify the traces of many of the animals that inhabit wooded areas.

THE TRIP:

General observations and recordings upon arriving at the area.

What season is this? (Early, late?)
What is the time of day?
How does the air feel? (Temperature)
What is the condition of the sky?
What is the direction and speed of the wind?
Look at the trees.
Are they moving? Do the trees appear to be conifers, deciduous, or a mixture?

Listen in silence.
What kinds of sounds do you hear?
Are the sounds coming from plants, animals, and/or man-made objects?
Is there repetition in the sounds you hear?
Describe the most outstanding sound you hear.

The next portions of the trip will be best accomplished if the class group can be divided into smaller groups of about 8-12 each. Each group can be equipped with binoculars, a set of identification keys, maps and camera.

Animal Traces in a wooded area

Look at the trees as you walk. Select a tree that appears scarred. Describe the scarring. Is it regular? irregular?
Is the scar fresh? Is it old? How do you know?
Is the tree living? How do you know?
Look for insects on the tree.

Look for bird traces in trees. Describe them.
Look for bird traces on the ground.
How were these traces made?
Record notes about these traces that will help you to identify them if you don't know what they are.

At which season are you more likely to find egg shell traces of birds?
If you find a feather, look for others close to the same area. Why?

Rope ring (The Woods Floor)

Place your rope ring on a leaf-covered section of the wooded area. Pick up the leaves in the ring and carefully observe the contents for animal traces.
What do you see in the leaves?

Look carefully at the ground under the leaves.
What do you see that doesn't look like a leaf?
Is anything moving? Describe it - shape, number of legs, lack of legs, wings, color.
Feel the leaves and earth. How do they feel, cool - warm, dry - moist, hard - soft?
How many different kinds of living organisms have you found?
What various stages of development in insects can you see? (Egg, larva, pupa, adult)
Look for other traces of insects. (Cocoons, webs, holes)

Under a rock:

Lift a rock or pull it back and look over the far edge.
Describe the earth under the rock. What is its color?
Describe any living organisms you see under the rock as to type, size, movement, color or lack of color.
Replace the rock in the same spot. Why?

Other animal traces

Listen for sudden sounds at ground level.
Look for signs of partially eaten plants, fungi, nuts, etc.
Look at leaves on growing plants. Do you see any indications that insects have been eating the leaves? What parts?
What would happen to a plant if the insects ate all of the leaves?
What would happen if the leaves were no longer available to the insects?
When does man try to control this?
What are the effects of man's seeking to control insect infestations?

Bones, fur and feathers

Look at and feel these remains if you find them.
(Explain that the children can examine animal remains but that these are best left in the area where they are found; that this is a natural phenomenon by which materials are re-cycled back to the soil.)
Examine the surrounding area for additional traces.
What remaining parts will help you to identify this animal?
Is this the remains of a bird, mammal, reptile, fish?
How do you know this?

ACTIVITY #56 Mature Forest: Layers

OBJECTIVES:

After or during the visit to a forest, the student should be able to identify the five layers of a stable or mature forest. (Floor, herb layer, underbrush or shrub, understory and canopy.)

The student should list animals that make their homes in the forest and tell in which layers the homes would most likely be found.

After observing whether there is little or considerable sunlight reaching a particular layer of the forest, the student should be able to point out indications of this amount of sunlight as shown in plant growth.

A student should be able to list two reason why this forest should not be destroyed.

The student should be able to give reasons why he would or would not like to have this forest near his home.

THE TRIP:

Divide class into groups of five or six children. Each group observes a different layer of the forest (floor and herb layer, underbrush or shrub, understory, canopy) in an area of approximately ten feet square.

What are the stems of the plants like? Are they woody or herbaceous?
Feel them and describe them. Are they rough? smooth? thorny?
How many different kinds of plants can you find?
Examine the leaves. Describe their shapes and colors. Compare the size of leaves on plants from your layer with size of leaves on plants of another layer.
Are there flowering plants on your layer? How can you tell?
Examine the soil around the plants. Feel it. Is it damp or dry?
Is this soil mainly clay, sand or humus?
Can you find decaying matter around the plants? Do you think it has always been there? Will it be there next spring?
Do the plants get much or little sunlight?
What signs of animal life can you find? Listen for sounds.
What kinds of animal homes can you find in each layer? What are they made of?

Describe their shapes and sizes.

Will the plants of the forest floor ever be a part of the canopy?
Do you think the canopy ever looked like the floor?
Describe what you think your layer will look like in twenty years.

ACTIVITY #58 Forest and Field

MATERIALS NEEDED:

Hand lenses; plain paper for each child

OBJECTIVES:

Given a prepared diagram, the student should be able to label correctly the five layers of the forest: forest floor, herb layer, shrub layer, understory, canopy.

The student should be able to construct a possible food chain based on the plant and animal life seen in the field or forest. The food chain should include at least three links: producer, first order consumer, and second order consumer.

THE TRIP:

In the field: What would be the first link in a field food chain? What might be second? third? fourth? What are the producers? Are the producers the same in the forest and field food chains? Why do you think plants can produce food and animals can't?

In the forest: Observe the layers that make up a forest. What plants make up the herb layer, shrub layer, understory and canopy? What is the forest floor composed of? What animals find shelter, food, or protection in each of these layers? What might be the first link in a forest food chain? the second? the third? What are the producers?

What animals can you find? Are any smaller than a quarter? Examine them with hand lenses. What color are they? How are they shaped? How many legs do they have? Do they have wings? Do they have eyes?

Are the same kinds found in woods and fields?

What animals are found here in the greatest numbers? How many kinds of insects can you see? How many can you hear? What evidence would tell you that insects have been living here even if you couldn't see them or hear them?

Give each class member a white sheet of paper to place on the ground. Watch it carefully for five minutes. How many kinds of insects do you see? Did anything else collect on the paper? What are the insects in this field doing?

ACTIVITY #62 Saplings and Field Succession

MATERIALS NEEDED:

Pencils, paper, compass, field guides on trees.

OBJECTIVES:

Children should be able to:

Locate the terminal bud scars on a twig.
Determine the age of twigs by counting the spaces between the terminal bud scars.
Estimate the age of saplings by use of terminal bud scars.
Name at least two distinguishing characteristics they used in differentiating saplings of various species.
Keep a tally of tree types found in the area under study.
Following a survey in which number and types of plant seedlings and saplings in a given area are tabulated, students should be able to predict what that area will be like in 10 to 20 years; whether it will be pond, marsh, field, or forest; and what the dominant species will be.

THE TRIP:

NOTE: Depending on the background knowledge the class already has, this may be limited to observations contrasting field, coniferous forest, and deciduous forest, or it may go into specific detail on species of various trees.

What will this field be like in ten - twenty years? Will it be a coniferous forest? Will it be a deciduous forest? Will it still be a field?
What might cause it to change? What might cause it to stay the same?
How can you find out?

Are there any conifers planted in the area? Are there different kinds of deciduous trees of a large size near the field or anywhere in it? How could you identify seedlings or saplings of these trees?

After the preliminary investigation, small groups or individuals may take a census of the seedlings and saplings by type. Results may be recorded simply by number or with symbols on a map of the field. (Background information: Among the species present may be tulip, oak, sassafras, dogwood, apple, wild black cherry, birch, beech, and red maple.)

How many seedlings were found?
Which species is most numerous?
Where are the seedlings coming from?
What might have influenced the pattern of distribution?
Where is each species most densely concentrated?
Are there any seedlings which have not come from older trees in this area?
How might such seedlings have gotten there?
Are there any types of large trees which do not seem to be reproducing?
Why might this be true?

What do you think this field will probably be like in ten-twenty years? Is there any reason to think this field will not become a forest? What might prevent the forest from taking over?

What other plants that are here now might disappear if this became a forest? Why do you think they would disappear? What other plants that are here now would you still expect to find here if this became a forest? What animal life can you observe here now? What changes in the animal life would you expect to find if this became a forest? Why?

How long ago did the largest saplings begin to grow in here? (NOTE: The most accurate answer may have to be "more than ____years ago".) How do the ages of the seedlings compare with the ages of the pines in the forest on both sides? Why do you suppose they did not begin to grow sooner? Can you find a sapling the same age you are?

Do you prefer this area as a field, or would you rather it became a forest? Why?
Are the natural values of this area greater in its present state than it would be as a mowed field or as a forest? Why?
Do you think this field should be mowed? Why?
Would every field eventually become a forest if man did nothing to interfere? Why do you think so?
From whose point of view would this be desirable?

ACTIVITY #63 Woods and Field - The Effects of Light

OBJECTIVES:

Children should be able to:

Approximate ages of saplings by use of terminal bud scars.
Find three leaves which are translucent and five plants whose leaves (or needles) reflect light.
Students should be able to describe at least three effects of light on living things.

THE TRIP:

What effect does light have on living things?

Examine the amount of undergrowth on the forest floor and in the field. Where is there the most growth?
Is the ground cover made up of the same kinds of plants in both places?
How would you contrast the growth on the floor of the forest and the ground cover of the field?
What measurements could you make to find some of the effects of light?
Do you think plants would grow faster in the forest or in the field? Why? (Allow time for speculation. Someone may note that the forest undergrowth is more spindly than that in the field.)
Which is more spindly? thicker? more mat-like?
What other comparisons could you make?
What might be an explanation for the differences you have noticed?
Compare the amount of light in each area.
Can this account for the differences? How?

Does one area have greens that appear more intense? Which area? (NOTE: It may be necessary to define intensity as the amount or saturation of color.)

If you can find some green leaves that have fallen on the forest floor, take them to the field and look at them there. Is there any change in intensity? Now take some leaves from the field into the forest. What observations can you make?

Does one area have greens of a predominantly different hue than the other area? (NOTE: Hue can be explained to the children in terms of a green with blue in it, a yellowish green, etc.) Does looking at such leaves in a different light seem to change the hue?

In which area do the greens seem to have more blue in them? yellow? Does one area have greens of a lighter or darker value than the other area? Does your observation hold true when you look at those greens in a different light? (NOTE: Value may be defined as being "light" or "dark".)

Do leaves transmit or reflect light?
Can you find a tree whose leaves are translucent?
Can you find a tree whose leaves reflect light?
Can you find plants whose leaves are translucent but also reflect light?
Do all leaves reflect light to the same extent?
Is there any characteristic appearance or texture to the leaves which reflect light?
Does the ability of the vegetation to reflect or transmit light have any effect on the light intensity in an area?
Is there any relationship between translucency and hue?
Is there any relationship between translucency and intensity?

ACTIVITY #65 Stream Study

MATERIALS NEEDED:

Strainers or dip nets; white enamel pans; small, wide-mouthed collection jars; identification keys; tape measure, stop watch, cork float; hand lens; thermometer; pencil and paper.

OBJECTIVES:

After completion of this field trip, the student should be able to:

Make simple, accurate measurements, using the instruments provided.
Given a list of observations and inferences, distinguish between observations and inferences.
Describe techniques used in collecting and identifying stream-dwelling specimens, and successfully collect and identify at least one specimen, returning it to the stream uninjured.
Measure water temperature and speed of flowing water.
Describe a stream food chain.

THE TRIP:

The Water's Edge

Does anything that you observe indicate the season at this point?
Measure the temperature of the water.
What does the soil at the water's edge look, feel, and smell like?
Look across the surface of the water. Is the water still or flowing?
If the water is flowing, measure the speed by marking off a 10 foot distance along the bank. Drop a cork at the beginning of the distance and, using a stop watch, measure the time it takes the cork to travel the 10 feet. From this, the current flow can be calculated in feet per second. Collect organisms from the flowing water. Compare them with organisms found in still water.

What signs of and types of activity do you see or hear?
Does the flowing of water affect the number or types of organisms found in the water?
What are the color and clarity of the water?
Do you see signs of water pollution?
What do you see that indicates the water is or is not polluted?

Look at plants growing close to the water; in the water; a distance from the water. Are there signs of man's influence at the water's edge? What are the colors of the plants, their leaves, branches, flowers, etc? Do they look like the plants seen in the distance?

Living Organisms (Insects)

How many different kinds of insects has the group collected?
Were eggs collected? How do you know that they are eggs?
How many legs do the insects have?
What methods of moving do you see being used by various insects?
Why do you think some insects fly? Why do some swim, walk, float, etc? Are all the insects in their final stages of development?
How do you know? What do the insects eat? Can you see their food? What may use the insects for food? Can you trace a food chain of the stream?
Which of these insects annoy man?
How does man try to control insect populations?
Does man always do "good" by spraying for insect control?
What happens to a food chain when certain members are destroyed?

Living Organisms (Amphibians)

What evidence do you see of amphibian life?
What do you see? What do you hear?
Do you see various stages of frog transformation from egg to tadpole to adult? Which stages do you see in the water?
Which do you see at the water's edge?
What do you think will prey upon amphibians in the food chain? What do amphibians prey upon?

Living Organisms (Reptiles)

Have you seen a snake today? Did you see a snake in the water?
Are all snakes poisonous?
Can you trace a food chain containing a snake?
If you have the opportunity, touch a snake. How does it feel: dry, moist, slimy?

ACTIVITY #66 Pond Succession

OBJECTIVES:

Children should be able to predict, in writing or drawing, what the pond environment will be like in 25 years and to give at least three observations made at the pond which have led to this conclusion.

In the weeks following the trip, some children should voluntarily visit other pond (or marsh) environments and describe their observations, either in conversation with the teacher, reports to the class, or pictures for the bulletin board.

THE TRIP:

NOTE:
This should be a "second trip" activity for a class which has already visited the pond to investigate the animal and plant life in it.

What is a pond?
Why is the pond here?
Will it always be a pond?

Where is the water coming from?
Where is the water going? Is any water going out that you don't see?
Does the amount going out equal the amount coming in? How can you tell? Why do you think this is the case? When might the amount going out exceed the amount coming in?

Observe the surface, shores, and bottom of the pond as well as the stream that feeds it. What else is coming into the pond besides water? How are these things coming in? Where are they coming from? Where will they go?
Where is most of the soil that has washed into the pond located? Why? What becomes of the leaves and other plant materials that enter the pond? Why?
Is this material (soil and plant materials) beneficial or harmful to the pond and its life? Why?
What changes will the invaders make in the pond over a period of time?
Will these changes be good or bad? Why do you think this?
How could man prevent these changes?
Would it be desirable to do so? Why do you think this? From whose point of view are you answering?

Do you see any indications that the shoreline is changing? Describe what you see and what you think is happening.
What parts of the shore show "overuse" by man? Do you think such intensive use will affect the pond? Why do you think this? How could it affect the pond?
Is this intensive use good or bad? From whose point of view?
What would the shoreline be like around the pond if it were fenced off and we couldn't get in close? Can you find any evidence to support your opinion? Would it be desirable to fence off portions of the shoreline from time to time? Why do you think so?
Is there anything that could be done to protect the shore from overuse?

What plants are growing along the shore? Where are their roots?
What will become of the seeds from these plants if they fall into the water? Why do you think this?
Will these plants continue to grow here? Will their numbers increase? Why do you think this?
How do you think these plants will change the pond environment? Will these changes be good or bad? From whose point of view?

What seeds have fallen into the water other than those from plants at the water's edge? Where did these seeds come from? Will plants grow from these seeds? Where? Why do you think so?

If this pond does eventually disappear, what will become of all the animals that live in the water? Why do you think this? Will this happen all at once?

ACTIVITY #67 Marsh: Plant Life

OBJECTIVES:

The observer should be able to describe, in his own words, two types of plant life at the marsh. His description should include his observations as to whether the leaves of this plant shed or retain water and his ideas as to why the leaves react this way.

THE TRIP:

How many different colors do you see?
Does this area have an odor? What does it smell like?
Describe in your own words what the plant life looks like.
Do plants around the marsh area differ from plants in other areas? Can you suggest some reasons why? How do they differ?

Have children discover that some plants retain water on their leaves while others seem to shed water (or water "beads" on the leaf surface). Have children take turns putting water onto various leaves to see what happens.

Try several leaves that grow around the marsh area: leaves from trees, skunk cabbage (why so named?), mayapple, jewel weed (why so named?), others.

What would happen to the plants if each child who came here took one leaf from the different plants?

What would happen to the leaves on these plants if it were to rain very hard for a few hours or longer? Do you think all plants need water? Do they need the same amount? Why do you think this?

Are there any plants growing in the marsh? Do they look different from the plants growing around the pond? How? Give some reasons why. Do you think these plants could grow in places other than in the marsh? Why?
What do you think causes water to "bead" on some plants, soak others and leave others dry? Have you ever seen anything like this anywhere else?

ACTIVITY #68 Marsh: Animal Life

MATERIALS NEEDED:

Strainers, small containers, large collecting pan, pictures of pond organisms to help with identification.

OBJECTIVES:

The observer should be able to describe, in his own words, two types of animal life found in the marsh. He should be able to describe differences between animals that live in the marsh and animals that live in other areas.

THE TRIP:

Use strainers to catch organisms from water, leaves, and mud. Place in water in small container. Transfer to large collecting pan, making sure that water is clear enough for observation.

Describe in your own words what the animal life in this area looks like.

Pretend you are telling about the marsh to someone who has never seen a marsh and probably will never see one.

How is the animal life in this area different from (or similar to) animal life in other areas?

What types of animal life are found in the marsh? How do you think the animals got there? What do you think they eat? How do they get their food? What would happen if no animals lived in the marsh?

What happens to the animal life during the winter?
Do you think the animals stay in the marsh? Where could they live if they left the marsh? What would happen to the animals in the marsh if it never rained?

ACTIVITY #69 Marsh Life

MATERIALS NEEDED:

Strainers, collecting pans, collecting jars, (enough for each child), pencils, writing paper.

OBJECTIVES:

Be able to recognize, from a group of pictures, three marsh animals.
Be able to give some needs that man satisfies from his environment and compare these with the needs of one marsh animal.

THE TRIP:

Do you see anything living in the marsh? What size is it? What does it look like? What colors do you see? How is the marsh area different from the nearby field?

Do you see any animals in or around the marsh that use the water in a way similar to the way we use it?

Water strider - swimming motion
Frog - swimming motion
Birds - drink it and get food from it
Forest animals - drink it and get food from it

What kinds of food could we get from the marsh?

What plants or animals do you know about that could live in the marsh?
What daily activities must the marsh animals carry on that man also must carry on?

Eat
Breathe
Activity - rest
Excrete
What others can you think of?

What do the marsh animals eat?
Do they need air? How do we know the animals use air?
How can we find out about the activities of marsh animals?
What have we been doing that could help us to understand the activities of marsh animals? What else could we do?

What would happen to the marsh life if the marsh became dry?
How could the marsh become dry?
How might the area change if the marsh disappeared? What would happen to the birds and other animals?

Use the strainers. Dip and collect marsh life. Discuss the objects and animals you've collected.
Have each child choose one of the animals and put it in a baby food jar. Ask the children to pretend they are that animal and write a story telling what their life is like.
Return the animals to a centrally located collecting pan and have the children sit around it.
Ask each child to read his story. See if the others can guess which animal the story was about.

ACTIVITY #71 Marsh Food Chain

MATERIALS NEEDED:

Dip net, enamel pans, magnifying glasses

OBJECTIVES:

Given a list of organisms from which to select, children should be able to construct at least two simple food chains, each of which includes at least three organisms observed in the marsh.

In the weeks following the trip, children should evidence awareness of food chains by pointing out the place of insects in a food chain involving other animals. Some children should voluntarily try some of the follow-up activities.

THE TRIP:

What signs of animal life do you see on the surface? in the water along the shore? in deeper water? in the air over the water? at the water's edge? What are these animals doing? Watch for indications of what they are eating.

What are the tadpoles feeding on? Where did this food come from? How will the tadpole's feeding habits change as it develops into a frog? Will that food supply be available here? Will all the tadpoles become frogs? Why or why not? What would happen if all did become frogs?

On what are the fish feeding? Why do you think so? Scoop up a panful of water. Look at it with a magnifying glass or binocular dissecting microscope. What signs of animal life do you see? Where do these fit into the food chain of the marsh? About how many of these would it take to support one fish? What would happen if we stocked the marsh with more fish? Should we stock the pond?

Scoop up a panful of mud from the bottom and examine it.
Examine decaying vegetation and undersides of the leaves of any water plants.
Examine the algae (with a magnifying glass or with stereoscope).
Where do these organisms fit into the food chain?

Are they part of the chain only if they are eaten? Why do you say this? What do you suppose they eat?

Do any birds seem to be getting food from the water or because of the water? What would happen if there were no birds?

Are any animals feeding directly on plants? What did you observe that made you think this?

Where do the plants get their food?

Do the animals contribute in any way to the plant life? How?

What are the producers in the marsh? What are some of the primary consumers? secondary consumers?

ACTIVITY #72 Marsh Survey

MATERIALS NEEDED:

Dip nets, 4 enamel pans or trays, magnifying glasses, thermometer; weighted line, at least 20' long, marked in feet; field guides to insects, birds, ponds; display board, thumbtacks, pictures of aquatic organisms; crayon, paper, scissors.

OBJECTIVES:

Children should be able to:

> Name and describe at least four different habitats found in most marsh environments; name at least two organisms which are commonly found in each habitat and explain how the needs of each of these organisms are better met in this habitat than in the others; describe the interrelationships within the habitats which make the marsh a total environment. Name three important modifications of organisms which enable them to live in water. Separate water and air dwellers from a given selection of specimens or pictures.

As an independent individual or group activity, children might experiment with setting up an aquarium, or make a diorama or mural of a marsh showing the various habitats, or visit other marshes and report about them to the class.

THE TRIP:

What do you expect to find living in the marsh? Would you expect to find the same things living in all parts of the marsh? Why? What are the parts of this marsh? (As the parts are mentioned, a flannelgraph marsh can be built up on the easel, each part being applied by children suggesting it.)

Divide into groups, with one group responsible for each of these marsh habitats. Assign one pan or tray for each of the first four groups.

1. Bottom (Mud and decaying vegetation)
2. Shallow water near shore
3. Deeper water
4. Surface
5. Air over pond
6. Shore

Each group will spend 15 minutes investigating its area and bringing specimens to the trays.

Groups 5 & 6 can make pictures of things they see but cannot collect, or can find these organisms among the cut-outs, putting these on the display board. (Other groups may use these also.)

After the group has had opportunity to inspect the results of each other's investigations:

Was anything living in the mud and leaves on the bottom of the marsh? What?
What did you find in the shallow water? What did you find in the deeper water? Did you see anything you couldn't collect?
What was on the surface?
What did you see in the air over the marsh?
What did you find along the shore?

Did you find the same things living in each part of the marsh?
What reasons can you give for this?
What are some of the things that make each of these habitats different?

Re-investigate the habitat previously investigated.

How deep is the water?
What is the temperature of the water in this area?
How much light does this area receive compared to the other areas?
What food seems to be available?
Is oxygen available to animals that breathe with lungs? with gills?
What is the color of the water at this place? Why might this be?
How much cover (protection from enemies) is available?
What are the factors that seem to make this part of the marsh the way it is?

Observe again the organisms collected. (Caution: Be sure enough water has been in pans and that specimens do not become overheated.)

What would these animals probably eat?
How would these animals get a supply of oxygen?
How are the organisms collected or observed adapted to living in the parts of the marsh where you found them?
In what parts of the marsh would they not be able to live? Why?
Could they live away from the marsh?

Which habitat seems to have the most organisms?
How are the organisms in each of the marsh habitats dependent on the other habitats of this marsh?
Which would be affected first if the marsh were drained? Why?
Is man dependent on a marsh? How?

ACTIVITY #75 Rainy Day

OBJECTIVES:

The student should be able to describe the effects of rainfall on several types of vegetation and predict the long-range effect of rainfall on areas lacking adequate vegetative cover.

THE TRIP:

Can you find things or areas that illustrate run-off? What do you notice about the run-off patterns on smooth-barked trees? What do you notice about run-off on trees with deeply-ridged, rough bark? What is the relationship of branch arrangement to pattern of the run-off? Are there different types of run-off on leaves? What seems to affect the way water runs off the leaves?

Observe the areas around the base of a tree as well as in the crevices of deeply ridged trees. Can you find places where the run-off has created a micro-habitat dependent on dampness? Find a tree with moss growing more abundantly at some portions of the base. Is the moss growth related to the tree's run-off pattern? Check several trees to determine if this relationship is repeated.

Find an area with little vegetation. How does the run-off in this area compare with that of a nearby well-vegetated area? Will this area look the same in ten years? Why do you think this? What could man do to change this area now? in ten years? What part will rain play in the future changes here?

Where do you find an accumulation of water among plants? Where among non-living things? Can you find any obvious effects of this water accumulation? Is water accumulation "good" or "bad"? From whose point of view?

ACTIVITY #76 Rainy Day

OBJECTIVES:

Students should be able to:

Describe the way various surfaces react to water.
Compare the differences in levels of land and relate these differences to the movement of rainwater.
Describe rain in terms of sound, feel and effects on color.
Name some things you could do or observe on a rainy day which could not be done or observed on a clear day.
During future rains, teachers may stimulate continued student interest in making rainy day observations, either as a class or individually.

In conversations with the teacher, or with their classmates, encourage students to describe some of their observations.

THE TRIP:

What color is rain?
How does rain affect other colors? Examine lichens and algae on wet and dry portions of tree trunks. What color is a rain drop on a branch? on a leaf? on a flower? in the air? bouncing out of a puddle?
What shape is a raindrop bouncing out of a puddle? falling through the air? hanging on a branch, on a leaf, on grass? Look through a raindrop hanging on a branch. Describe what you see.
Count the seconds between the time a raindrop falls from a branch until another one collects in the same spot and falls. Compare your raindrop count with that of a friend counting raindrops on another branch. Whose raindrops drop faster? Why?

Do raindrops always collect at the same place on a branch? Why do they collect where they do? Are all the raindrops on your branch the same size when they fall? Notice the length and width of raindrops. Find the biggest raindrop you can. Find the smallest. Is there a relationship between raindrop size and how often they fall from a branch?

Look at the surfaces of different kinds of leaves, such as mayapple, violet, garlic, jewelweed, different grasses, solomon's seal, holly, beech, maple (or whatever variety of leaves are common and in season).

Do they look wet? Do they feel wet? Are some wet all over or just in spots? What spots? Be sure to look at a leaf from several angles. Does there seem to be a characteristic texture to leaves that are wet just in spots? Try to describe what you feel. Have you ever spilled water and watched it bead in spots only? Where did that happen? What reasons can you think of that might cause some leaves to be wet in spots only? Are your explanations really facts or are they inferences? NOTE: Take time for the group to share their opinions on this subject and to evaluate them.

Turn some of the leaves over and observe how the rain "wets" the underside. Does the leaf's underside react the same as the leaf's upper surface? Does the underside look the same as the upper surface? Does it feel the same?

Look carefully. Can you find any leaves with "down" on them? How do these leaves look in the rain? How do they feel?

How do plant and leaf shapes shed or hold water? What happens to the rain that falls on the leaves of different plants?

Find some plants that are in bloom. Are the flowers open or closed? Why might this be?

Can you find some things that look dry but are wet?
Can you find some things that look wet but don't feel wet?
Can you find anything that is dry? Why is it dry?

Feel the dead leaves on the ground. Are they wet? How would you describe the feel of the wet leaves? Try to find some dry dead leaves. Do they feel the same as the wet ones? Do wet dead leaves feel the same as wet living leaves?

Listen to the rain on your raincoat, rain hat (umbrella, poncho, or whatever it is!).
Stand under trees and listen; stand in the open and listen.
Do all raindrops sound alike? Do you hear as many in both places? Describe the differences. What seems to cause the differences in sound? Can you hear rain more easily under trees or out in the open? Listen to the rain falling on the ground under trees and on the grass. Listen to rain falling into a puddle and, if possible, into a stream. Try to describe what you hear. Is what you hear rain or wind?

Smell! How do these things smell when they are wet: on grass, different bushes and flowers, tree bark, dead leaves, the earth, your raincoat?

What do animals do in the rain? Look for spider webs. Are they wet? Are they wet all over? Are the spiders in them? Do the spiders look wet? Look for insects. Do they look wet? Where are they? What do they seem to be doing?

Do you hear any birds? Do you see any birds? Where are they? Are the birds you see making any noise? What do they seem to be doing?

Watch for other animals. Do you see many? What are they doing? Do they look wet?

Find some puddles. Do you find more puddles on the driveway, on the grass, under trees?
What is the surface of the earth like where you find the puddles? What covers it? Is it flat? sloping? What is the area around it like? How does the area around the puddle feel when you walk on it? Compare the height of the area around it with the area where the puddle is.

Is the drop that you see bounce up the same drop that fell into the puddle? What makes you think so? What happens when a raindrop hits the puddle? Describe what you see.

Guess why puddles form where they do and not in other areas. Think of places near your house where there are many puddles during a rain. How are those places like these places that have puddles?

Where does the rain go that doesn't go into puddles? Where will the rain go if this puddle gets bigger? Where will the water in this puddle go when it stops raining? What good are puddles? Are puddles ever not good? Where? When? Why? Do raindrops falling in a puddle look like raindrops falling on a pond? Do you think a pond is really a big puddle? Why?

ACTIVITY #78 Windy Day in a Forest

OBJECTIVES:

Students should be able to notice changes that occur in a forest on a windy day. The student should be able to describe verbally four observations he made when the wind was blowing and compare them with observations made during a period of relative calm.

THE TRIP:

How many different sounds can you hear when the wind is blowing?
Can you hear the same sounds when the wind isn't blowing?
What happens to the trees when the wind blows?
Can you tell the direction of the wind by watching a tree?
How?
Does the wind always blow in the same direction?
Can you feel the movement of a tree by touching the trunk of the tree as the wind is blowing? What part of a tree sways most?
Can you tell the speed of the wind by looking at a tree?
Do all trees move when the wind blows? Do all trees move the same?
Which trees move most when the wind blows? What words describe the trees that have the most movement when the wind blows?
How could the wind be damaging to the trees?
Can you find any trees or parts of trees that might have been blown down by the wind?

ACTIVITY #80 Rocks and Minerals

MATERIALS NEEDED:

Magnifying glasses, penny, pocket knife.

OBJECTIVES:

Students should learn to use their senses of sight and touch to examine rock specimens, and to observe and describe the characteristics of these specimens in terms of color, texture, cleavage, hardness and relative weight. They should learn to observe the environment in which the specimen occurs.

When rock specimens are brought into the classroom, students should use techniques of observation used on the field trip. The child bringing in the specimen should know where he found it and be able to describe the environment to the class.

THE TRIP:

Describe the external characteristics of the rock you have found.

What is its color?
Is it the same color all over?
Is the color solid, or is the rock speckled?
Do you think this is the true color or has something stained the rock? How could you find out the true color?

What is the shape?
Does it have rectangular edges?
Is it rounded? (What may have caused this rounded shape?)
How heavy is it? Is it heavier or lighter than you expected it to be?
How does it compare with a familiar object of the same size, such as a baseball, an egg, an eraser, etc.?
What is the texture: smooth? porous? crumbly? sandy? (What descriptive words can you use?)

How could you get a better idea of the real color and cleavage of this rock? (CAUTION: When breaking open rocks, be sure those taking part have eyes protected with safety goggles.)
Is the rock the same color on the inside as it is on the outside? (If not, why not? Which is the true color of the rock?)
Describe the interior color. Is it one color? Does the color appear in lumps or speckles?
Examine the interior with a hand lens. What do you see?

Do you see any indications of sedimentary formation? What? Describe the texture on the freshly broken surface. Describe the cleavage. Are there any crystals? What shape are they? How many sides does each have?

What is the hardness of this rock? Will it scratch your fingernail? a penny? the blade of the knife? Can it be scratched by your fingernail? the penny? the knife?

How is this rock a part of the total area? Is it part of an outcropping of underlying rock? Are there large boulders like it here? Are there many pieces like it here? Might it have been carried here by a stream? by gravity? by man?
What is this area: a roadside? a part of a farm? the base of a mountain? the floodplain of a stream? Is rock of this type weathering into soil here? (What makes you think so?)

Do you think this rock is composed of only one mineral, or does it seem to contain more than one mineral? Have you tested for only one mineral, or have you carried out your investigations for each of the minerals in the rock?

ACTIVITY #82 Soil

MATERIALS NEEDED:

Water; magnifying glass.

OBJECTIVES:

Children should be able to:

List three components of soil.
Describe orally differences in texture, color and water absorptive quality of a variety of soils (at least two varieties after the trip: more, if follow-up activities are used.)
Participate in class studies of soil by bringing in soil samples and/or performing the experiments.
Make "soil" and grow seeds in it.

THE TRIP:

What color do you think soil is?

See what colors of soil you can find in this area. Allow at least 15 minutes for investigations.
What seems to be giving the soil these colors? Of what is soil made? Did you see anything that makes you think this?
(NOTE: If children do not suggest that rock crumbles into soil, ask such questions as: Did you find anything else on the path the same color as the soil? What happens to the stones when you rub them together?)
What causes the rock to break down into soil?
Can you find any rocks which show signs of weathering?
Can you make soil from any of the stones on this path?
(Allow about 15 minutes for experimentation. Safety glasses should be worn if rocks are to be broken.)
How does your soil look compared with what is already here?
How does it feel? Squeeze a handful of your soil and a handful of soil that was already here and seems similar to it.
Compare the texture, the way the squeezed handful holds together.
How would you describe any differences? Look at your hands.
What color are they? Smell the soil you have made. Does it have any odor?

Is there anything in the soil besides pulverized rock? Investigations should not involve tearing up plant roots. Look for areas where the soil is already partially exposed.

Take a handful of soil from near the roots of the grass. Squeeze it, holding your hand near your ear as you do so. Do you hear anything? Describe what you hear. Compare the squeezed sample with yours. Compare the texture of this soil with the soil you made. Smell this soil. How would you describe any odor you notice? Look at the color of your hand. What do you notice? Examine this soil carefully, using a magnifying glass if you have one. Do you see anything in it that was not in yours? What? Look around to see if you can get any idea what this is. Does what you see help explain what you heard and smelled? How?
Spread out several handfuls of this soil and describe all the differences you have noticed in the preceding investigations.
NOTE: If the weather has been dry for a long period of time, it may be necessary to pour a little water on the soils being examined. Even if the soil is moderately moist, if time permits, further observations can be made by pouring water on soil and observing what happens. Was the water absorbed? How quickly? If not, where did it go? What went with it? What color changes took place? What happens now if you squeeze a handful?

If you were going to make the very best possible soil you could make, what would you put in it?
Of what value are the rock particles in soil?
Of what value are the plant particles?
Of what value are the animals?
To whom are these things valuable?

ACTIVITY #83 Erosion (Rainy Day)

OBJECTIVES:

When asked to write a paragraph about erosion, the student should be able to:

Describe three factors contributing to erosion control.
Suggest at least two methods of erosion control.

THE TRIP:

Look at a grassy hillside or any sloping piece of ground. Can you see any water running over the soil? Where do you see water? Where is this water going? Compare an open piece of soil with one covered with grass or other plants. Is the run-off from these areas different?
How does the contour of the land affect the run-off pattern of the water?
Trace the flow of surface water to its source.
What path does it follow?
What factors will affect the speed of the water run-off?
Which areas do you think are damaged the most by erosion?

What natural methods of erosion control do you see? What artificial (man-made) methods of erosion control do you see? What would happen to this area in a rainstorm if all plants and trees were suddenly removed? What makes you think this? Have you observed examples of this or have you learned of this through reading or hearsay?

ACTIVITY #84 Hydrographic Stream Study

MATERIALS NEEDED:

Thermometer, pencils and paper

OBJECTIVES:

When asked to write a paragraph describing the stream, the student should be able to describe several different features of the stream. Some descriptions should demonstrate the use of senses other than sight.

THE TRIP:

Look toward the creek from a distance. How can you infer that there is a stream at that location? (Different vegetation, topography of the land) Do you think the stream has always followed the same course as now? What evidence do you see that the stream has changed course? (Flat deposited land, steep undercut banks.) What evidence is there that the stream is changing its course right now?

What signs of life do you see along and in the stream?

What things do you see floating on the surface of the stream? What things do you see floating beneath the surface of the stream? Do all floating objects move at the same rate of speed? What things do you see that cause differences in the current?

Try to predict the path the current follows. Go upstream and overturn several rocks to muddy water. Watch the flow of muddy water. Does the flow of muddy water follow your predicted path? If not, why?

Look for places where the current seems to be absent, or to move upstream. (NOTE: These are called eddies. They are most often found on the downstream side of rocks or other protrusions. Why?

Does the water flow more swiftly near the shore or near midstream? (How can you find out?) (NOTE: Where the stream makes an S curve, the rate of flow will not be equal on the concave and convex sides. Why? Where is the water flowing more swiftly? How does the speed correspond with the depths on the curves?

Can you tell the depth of the stream? How? Is the depth of the stream the same at all places? Why not? Where does the water appear to be the deepest? What words describe the appearance of the water where it appears to be the deepest?

Compare the "deep" areas of the stream with the "shallow" areas. List ways they are alike; different.

Is the water always the same depth? What are some things that change the depth of the stream? Find two things in or on the banks of the stream that would indicate the level of the water changes.

How does the water feel? Does it always feel this way? What things would change the feel of the water?

Can you find a good site to build a bridge? Can you find a good site for building a dam? Can you find a poor site? Why did you make your choices? What would happen to the area if a dam were built?

Turn over rocks and dig in the muddy bottom portions of the stream to find "creatures". Be sure to replace the rocks once you have examined them. Remember, creatures live there.

Feel the rocks above the surface of the water. Feel the rocks beneath the surface of the water. Describe how they feel. Do they feel the same above the surface as they do beneath the surface? Explain the differences.

Can you find a place in the stream where it has changed its course?

What are the sources of a stream?
Do you see or can you find any places where water is entering the stream?
Do you see any places where water has entered the stream at some other time? Why do you think it is not entering from there now?

Does the stream stay the same size its entire length? If we walked upstream, what would you expect to happen to the width of the stream? What would you expect to happen to the depth of the stream? What would you expect to happen to the width and depth of the stream if we walked downstream?

How does the contour of the land affect the course of the stream? How does it affect the flow patterns of the stream? Can you predict where the stream would be narrow or wide by looking at the

contour of the land? How has the stream affected the contour of the land? Has the stream always been in the same place? (What makes you think this?) Will the stream be in the same place next week? next month? next year? 100 years from now? What makes you think this? (Look for places where the stream is presently eroding banks, building and removing sand bars. Compare with observations made regarding water speed and depths on S curves.)

Is the appearance of the stream in a meadow area the same as in a wooded area? List the differences and similarities.

In what parts of the stream can you see your reflection or the reflection of some object? Can you see it all the time? (Why not?) In what parts can you not see a reflection? Why?

Study the surface of the stream. What does the surface appearance tell you about the bottom of the stream? Try to make a profile sketch of a stream section showing the factors contributing to its surface features.

Take samples of water from a swiftly moving portion of the stream and compare them with samples taken from a slow-moving portion of the stream.

Record the temperature of the water, of the air above the water,and of the air a distance from the water.

Explain the concept of pH and how pH can be measured. Have students check the pH of the soil, the soil from the stream bottom, and the water of the stream. Did any of these areas have the same or nearly the same pH? If any of the areas were the same or nearly the same, can you account for the differences? (This may be difficult to tell, but don't let that stop the discussion.)

What signs of man's activities do you see in or around the stream?

ACTIVITY #88 Man and His World

OBJECTIVES:

The student should be able to list two changes that man makes in his environment for each of the following needs;

Food, shelter, clothing, warmth, transportation, and pleasure.

THE TRIP:

How can you tell that man has changed the landscape? (Kinds of trees, number of trees, arrangement of trees, etc.) If the land went untouched, how might a grassy field look after one year? five years? fifty years? Could you predict which of the original plants would continue to reproduce themselves? What information could be used as a basis for such predictions?

Would a slope facing south have the same vegetation as a slope facing north? Would the vegetation along a creek be the same as that on hillsides? How can you find out?

Can you find plants growing in the area that were probably planted deliberately? How did the others get there?

Are the changes man has made here good or bad? From whose point of view? What are some reasons that man makes changes in his environment? Do any other animals change the environment? How? Why?

What changes does a farmer make in the environment to grow wheat, corn, or other food crops? How do these changes affect the animals native to the area?

What changes would a farmer make in the environment to raise cattle or sheep? How would these changes affect native plants and animals?

What does man take from nature to supply himself with clothing, warmth, shelter, transportation, and pleasure?
How are these things returned to the environment to insure a continuing supply? Can they all be returned?

What value is there in a park or wilderness area besides providing a pretty place to visit? (The values will vary according to the type of area. Swamps and marshes provide natural flood control and water storage as well as nesting areas for birds. Wooded areas provide good "air conditioning" in the summer through evaporation, give food and shelter to birds who eat many insects unappreciated by humans, etc. Try to follow each of these values back far enough to show the direct or indirect benefit to man. Though he can use his environment for his own purposes, abuse of it will eventually harm him, since he is himself a part of the ecosystem.)

FOLLOW-UP MASTER KEY
LEVEL III

Page		Title	Level K	1	2	3	4	5	6	Season*	Activity
Seasonal Follow-Up Activities											
FLP# 12	2f	BIRD MIGRATION						x	x	F	4
FLP# 4	4f	STORIES IN SNOW						x	x	W	7
FLP# 6	7f	SNOW STUDIES			x	x	x	x	x	W	7,9
FLP# 7	9f	THE MARSH IN WINTER						x	x	W	11
FLP# 8	10f	FEEDERS TO MAKE	x	x	x	x	x	x	x	F,W	4,7,9,10
FLP# 9	11f	TREE BUDS					x	x	x	Sp	16,29,31
FLP#10	12f	SPRING FLOWERS I			x	x	x	x	x	Sp	19,30
FLP#11	13f	SPRING FLOWERS II			x	x	x	x	x	Sp	19,30
FLP#12	15f	BLUEBIRD HOUSE			x	x	x	x	x	All	17
Flora											
FLP#15	18f	SPORE PRINTING			x	x	x	x	x	F	23,24
FLP#16	19f	SOIL CONTENTS						x	x	F, Sp,Su	82
FLP#17	20f	GROWING MICROSCOPIC ORGANISMS						x	x	F. Sp, Su	24,82
FLP#18	21f	DECOMPOSERS IN A TERRARIUM					x	x	x	F, Su	24.
FLP#19	22f	JACKS AND APPLES						x	x	Sp	18
FLP#20	23f	FLOWER TYPES						x	x	F,Sp,Su	20,27
FLP#21	24f	BEWARE THE POISON IN THE BACKYARD						x	x	All	5,27
FLP#22	30f	PRETTY BUT POISONOUS						x	x	All	5,27
FLP#23	31f	NAME THESE POISONOUS PLANTS					x	x	x	All	27
FLP#24	32f	BUDS			x	x	x	x	x	W,Sp	21,31
FLP#25	33f	AGE SAPLINGS AND TWIGS						x	x	F,W	31,62,63
FLP#28	37f	FRACTIONAL TREE HEIGHTS						x	x	All	36
FLP#29	38f	STORIES IN STUMPS						x	x	All	25
FLP#30	39f	NEIGHBORHOOD TREES						x	x	All	32
Fauna											
FLP#32	42f	EARTHWORMS						x	x	F,Sp,Su	47

FOLLOW-UP ACTIVITY
MASTER KEY
LEVEL III

	Page	Title	Level K	1	2	3	4	5	6	Season	Activity
Fauna											
FLP#33	43f	EARTHWORMS						x	x	F,Sp,Su	47
FLP#34	44f	INSECTS AT HOME					x	x	x	All	40,41
FLP#35	46f	INSECTS AND TEMPERATURE				x	x	x		F	38,40,41
FLP#36	47f	ANT FARM					x	x	x	F,Sp	39
FLP#37	48f	HOW TO SET UP AN ANT FARM FOR STUDY					x	x	x	F, Sp	39
FLP#38	49f	SPIDERS						x	x	F,Sp,Su	42
FLP#39	52f	SPIDER WEBS						x	x	F,Sp,Su	43,46
FLP#40	53f	SPIDER WEBS						x	x	F,Sp,Su	43,46
FLP#42	57f	ANIMAL TRACES						x	x	F, Sp,Su	53,56
FLP#43	58f	ANIMALS AT HOME						x	x	F,Sp,Su	53
FLP#46	61f	SPRING BIRDS			x	x	x	x	x	Sp,Su	17,49
FLP#47	62f	BIRDS IN HABITATS				x	x	x	x	All	4,49,51,52
FLP#48	63f	FIELD STORIES OF BIRDS						x	x	F,Sp,Su	4,51
FLP#49	64f	BIRD IDENTIFICATION			x	x	x	x	x	All	10,17,50,52
FLP#50	65f	BIRD RIDDLES						x	x	F,Sp,Su	49,50,51
FLP#51	66f	BIRD DIETS							x	F,Sp,Su	49,51
FLP#52	67f	BEAKS AND FEET			x	x	x	x	x	All	10,50,52
FLP#53	68f	MARSH OR STREAM ORGANISMS			x	x	x	x	x	All	64,65,68-72
Habitat Studies											
FLP#54	74f	HABITATS					x	x	x	All	58,62
FLP#57	77f	OBSERVATIONS, INFERENCES: Woods, Trees					x	x	x	All	88
FLP#58	79f	SURFACE TENSION					x	x	x	All	65,72,84
FLP#62	83f	MARSH FOOD CHAIN					x	x	x	All	57,68,71
FLP#63	84f	POND DATA SHEET				x	x	x	x	All	67
FLP#64	86f	MARSH-HERBIVORES						x	x	All	71
FLP#65	87f	POND SUCCESSION					x	x	x	All	66
FLP#66	88f	POND WATER					x	x	x	All	66
Weather, Geology, Soils, Hydrography											
FLP#68	92f	WIND									
FLP#69	93f	SOIL COMPOSITION						x	x	F,Sp,Su	82
FLP#70	95f	BERLESE FUNNEL	x	x	x	x	x	x			

FOLLOW-UP ACTIVITY
MASTER KEY
LEVEL III

Page		Title	Level K	1	2	3	4	5	6	Season	Activity
Weather, Geology, Soil, Hydrography											
FLP#71	96f	SOIL MATHEMATICS------						x	x	All	82
FLP#72	97f	SOIL MATHEMATICS FOR TEACHERS----------						x	x	All	52,82
FLP#73	98f	ROCKS AND MINERALS				x	x	x	x	All	79,80
Awareness, Man and Nature											
FLP#74	99f	USING YOUR SENSES ----						x	x	All	88
FLP#78	104f	FROM THE WINDOW OF THE BUS----------						x	x	All	88
FLP#79	105f	ON THE BUS----------				x	x	x		All	88
FLP#80	106f	EVERGREEN FEELINGS----						x	x	All	36,61
FLP#81	107f	FEELINGS IN THE FOREST				x	x	x	x	All	36,61
FLP#82	109f	DROP COOKIES----------					x	x	x	All	88

*F=fall, W=winter, Sp=spring, Su=summer, All=all seasons

FOLLOW-UP #2 Bird Migration

IN THE CLASSROOM OR AT HOME

During the winter, revisit this area and watch for birds. Compare kind and number you see in an hour now with what you observe then. Return in the spring and make the same comparisons.

Keep a record of all the birds you see during the winter months.

Investigate bird migration. Do any birds migrate into this area in winter? Where do familiar birds spend the winter? What determines the times birds migrate? Is it temperature or some other factor? How could you get first-hand information on this?

To understand why some birds migrate we may have to ask how other animals spend the winter. Make first-hand observations if possible.

If you were looking for a warm place to spend the winter, where would you go if you were an insect? if you were a frog? Take the temperature of likely hiding places. Don't forget to check under the bark of trees, beneath stones, behind parts of your house. Compare these with the temperature outside. How would you measure temperatures in different parts of a pond? What birds depend on these "disappearing" species for food in the summer?

Watch for birds flying. (Best time of day is early morning or near dusk.) Keep daily counts of how many you see flying south compared with the numbers flying in other directions. Are more flying south than in other directions? Does the number flying south increase or decrease over a two-week period?

Keep a list of the birds you see every day for the next month. See if you can discover when robins "go south". Your list will have more meaning if you record how many of each species you see daily.

FOLLOW-UP #4 Stories in Snow

Light, Color and Temperature

Take squares of different colored materials, being sure all are the same size and the same kind and weight of material. Lay each square on the surface of the snow, all in the same area, so that each gets the same amount of sunlight. (Did you include a square of white?) After an hour, check to see if any of the squares have sunk into the snow. If so, which ones have sunk the most? the least? Record results.

Now lay the squares on some other surface with a thermometer under each. After 15 minutes read the temperature on each thermometer. Record each. Do these temperatures reflect the rate at which the squares sank into the snow?

Do you get the same results on a sunny day and on a cloudy day? What happens if you do the experiments in the shade? under an electric light?

What can you find out about the effect of color on temperature? How do architects, interior decorators, house painters, automobile manufacturers, clothing designers and other commercial people use these principles?

Air Pollution

Tack a clean white cloth to a board, and lay it outside. After several hours bring the board inside and examine the cloth. Is it still clean? With a hand lens, can you identify some of the particles? Which ones seem to be natural debris, such as bits of leaves, twigs, etc? How much of the material on the cloth could be classed as pollution?

Where does the pollution come from? Get permission from an automobile driver to hold a clean white cloth six inches from the tail pipe while he runs the car's engine. If someone you know smokes, ask him to exhale into a clean white tissue. See how many sources of pollution you can find in your home and school neighborhoods. (Note: It has been estimated that 34 tons of pollutants fall on a square mile of land surface annually.)

Can you smell pollution as well as see it? Keep a record for several weeks or days when you can smell unpleasant odors. Record the wind direction and weather conditions, such as foggy, clear, damp, etc. You might want to check the newspaper or weather report on TV for the humidity. Are there certain conditions under which more odors are noticeable? Why?

What local, state, and federal laws are attempting to control air pollution? What organizations are working on the problem?

FOLLOW-UP # 6 Snow Studies

I. Snow - (Observation and science activities)
   1. Let snow flakes fall on black paper; look at various shapes with a magnifying glass.
   2. Put a can outside to catch snow. Measure height of snow in can, bring in and let melt; then remeasure.
   3. Make a footprint in the morning, measure ; measure it again at the end of the school day.
   4. Go out and make observations about depth of snow, melting pattern, drifting pattern.
   5. Put water from faucet into cup, place outside with a thermometer. Note temperature and time it takes to freeze.

II. Snow (Art)
   1. Make a snow flake from cut paper.
   2. Draw a winter scene with chalk or crayons, then use white tempera to add snow where children have observed snow accumulates.
   3. Make a booklet of winter observations, birds, bare trees, brown grass.
   4. Make soap suds pictures (Ivory Flakes & water).
   5. Create snow bulletin boards.

III. Snow (Language arts)
   1. Write stories about
      How snow feels
      How snow looks
   2. Keep a chart or booklet about all information discovered in observations of snow.
      How often it snows
      What is snow
      Characteristics of snow
   3. Make a snow dictionary - Water vapor, drift, flake, melt, cloud, freezing, temperature, thermometer, ice.

IV. Winter
   1. Start in the fall and draw attention to two trees, one evergreen, one deciduous. Draw pictures of the trees each month. Write a story about weather and observations of trees. (You can do this with bushes or grasses. Add to the booklet each month as a diary of seasonal observations.)

2. Make trips in schoolyard and neighborhood and find signs of winter.
3. Dig up piece of soil and plant it (soil that looks bare).
4. Plant an abandoned bird nest (seeds in grassy nest will grow).
5. Observe winter birds and help a class or individual record.
6. Make bird houses and put out winter feed. Observe and record.
7. Measure shadows of children at same time of day in same place at the beginning of each month.
8. Keep a dictionary of winter words - hibernation, migration, cold, freeze, etc.
9. Make a bulletin board of ground, trees, bushes, sky. Place pictures of hibernating animals and insects. Cover animals and make a lift up panel to discover animals beneath. Label spots so children can identify words with animals.
10. Make up poems, stories, and songs about winter.

FOLLOW-UP # 7 The Marsh in Winter

On the bus
Watch for marshy areas and streams. Are they frozen - completely?

In the classroom or at home
Fill an ice cube tray with water and place in freezer. Check it every 15 minutes. Where does ice first begin to form? What is the last part of the cube to freeze? Why might this be? Is this like the pond? How is the ice-cube tray different from the pond? Can you actually duplicate the pond in your freezer?

Chill a dish in the refrigerator on a day when the outdoor temperature is below freezing. Put an ice cube in it. (Measure the size of the cube carefully!) Put the dish outside. Does the ice cube change in size? Did it melt? evaporate?

Use several dishes, each with a cube of the same size. Put one in sun, one in shade, one in windy, sunny place, one in windy, shady place. Check and compare cube sizes every few hours.

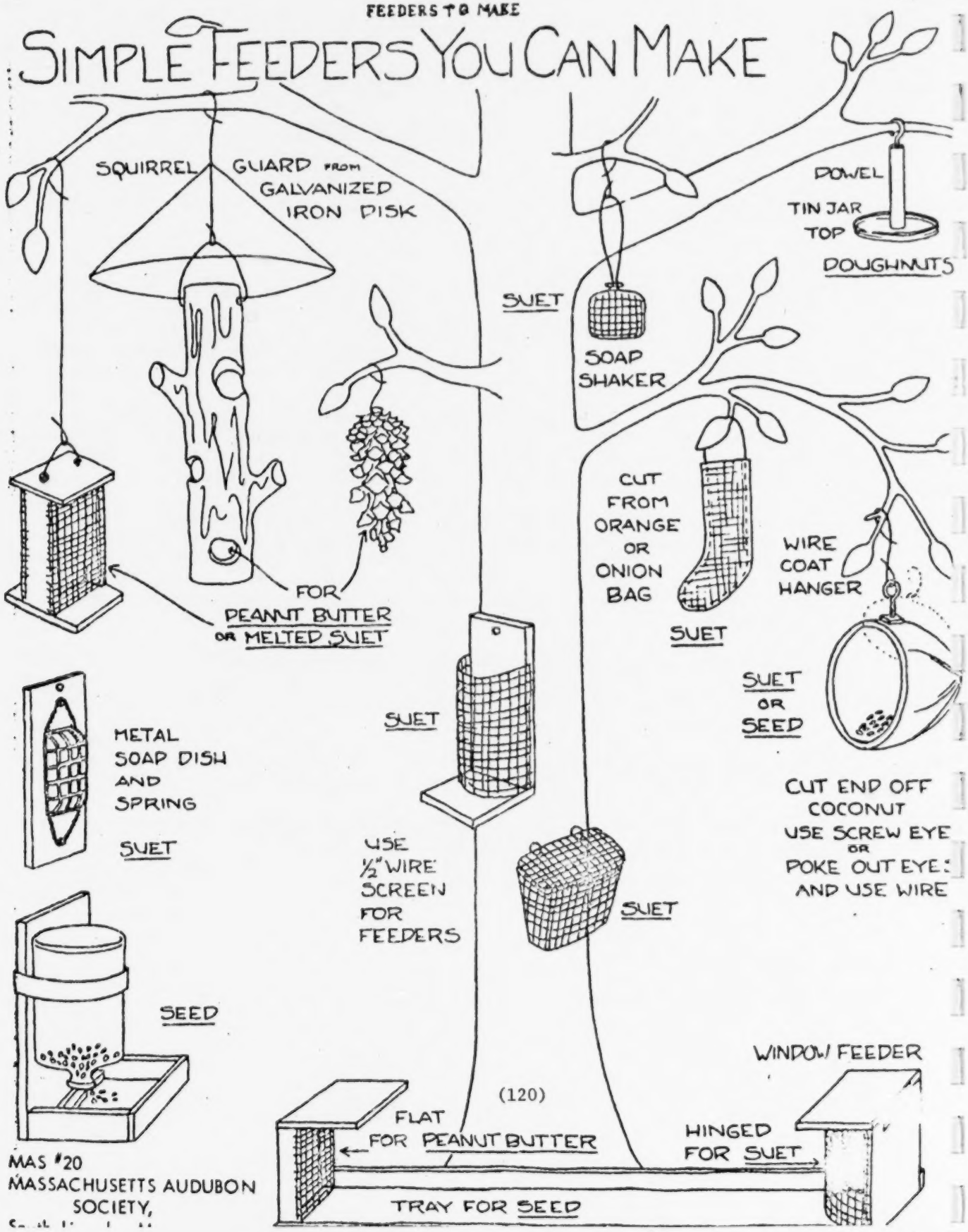
Wet a rag. Hang it outside on a day that is below freezing. Does it dry? If so, what happened to the water?

Does water always freeze at the same temperature?
Can you add anything to the water that changes the freezing temperature? Try salt, sugar, soap, glycerine, silt. Record results.

Examine frost patterns on windows. Is there anything you can do to influence the kind of pattern formed?

Read "December" from The Vision of Sir Launfall by James Russell Lowell. Can you illustrate it?

SIMPLE FEEDERS YOU CAN MAKE



MAS #20
MASSACHUSETTS AUDUBON SOCIETY,

FOLLOW-UP #9 Tree Buds

Observe opening buds on trees and other plants around school and home. Keep a diary of opening dates for various species. (A 5th or 6th grade class might be interested in being part of a 5-year study of opening dates with temperature correlations.)

Compare leaf and flower buds on trees, shrubs, and herbaceous pl around school and home. Which open first?

Research: Is there any relationship between the dates various species of trees leaf out and their geographic distribution?

Experiment: Try forcing some branches indoors. Which has the greatest effect: temperature, light, or other factors?

Compare "halves". Is there a higher rate of symmetry amongst leaves which emerge folded in half or leaves which emerge pleated or curled?

Packaging: Experiment with various ways of folding a tissue, silk scarf, or paper to pack it into the smallest "envelope". [Note: young leaves emerge as minature leaves. Following subsequent growth and development they become mature leaves.]

With a razor, take a cross section of various types of buds to view the "packing" arrangements.

Research and further outdoor investigation: What are bracts? What is their function?

Make designs using the leaf arrangements noted on the trip (and since).

When do buds form on trees and shrubs?

FOLLOW-UP #10 Spring Flowers

FOLLOW-UP #11 Spring Flowers '1

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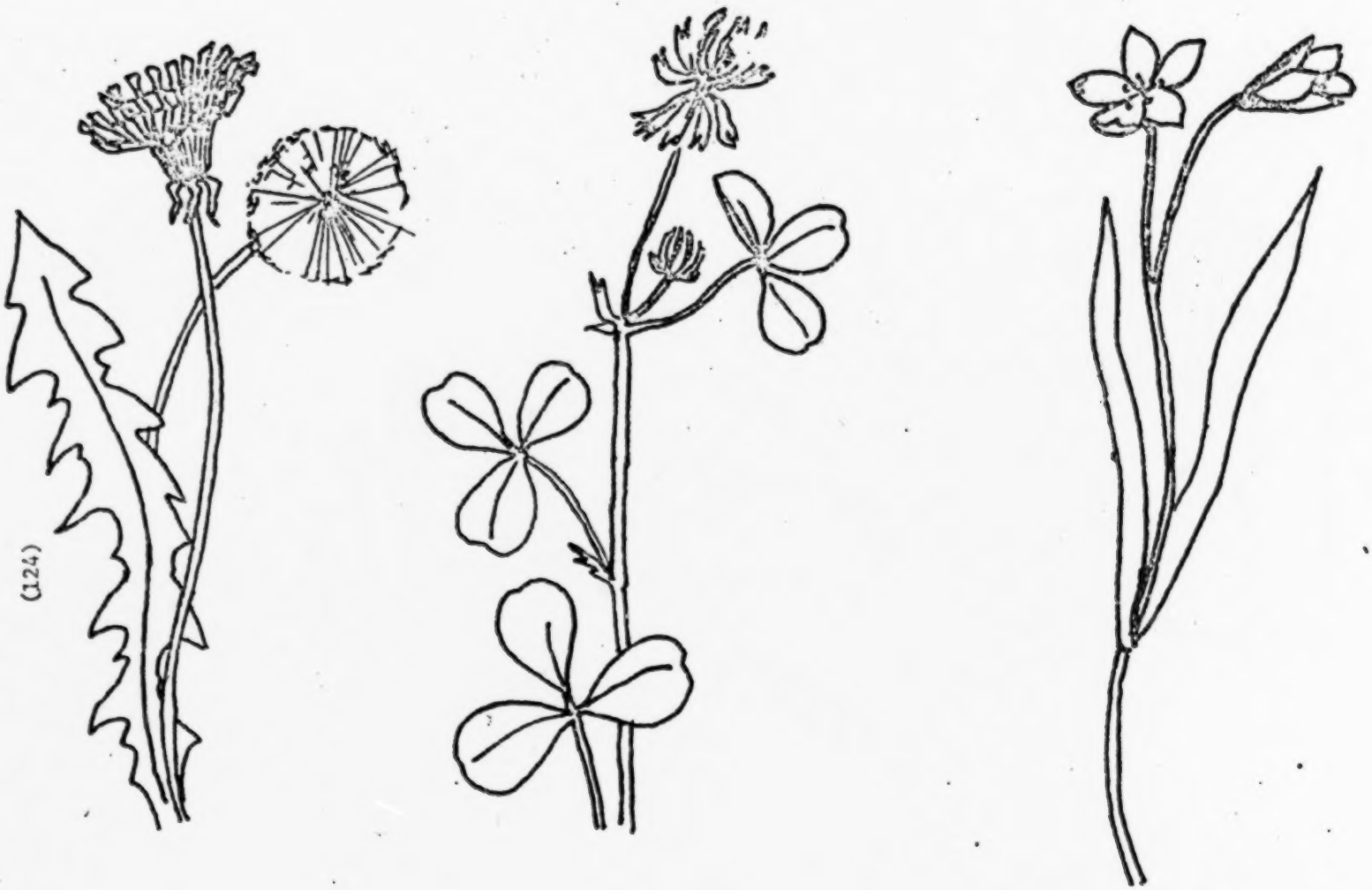
FOLLOW-UP #11 (continued)



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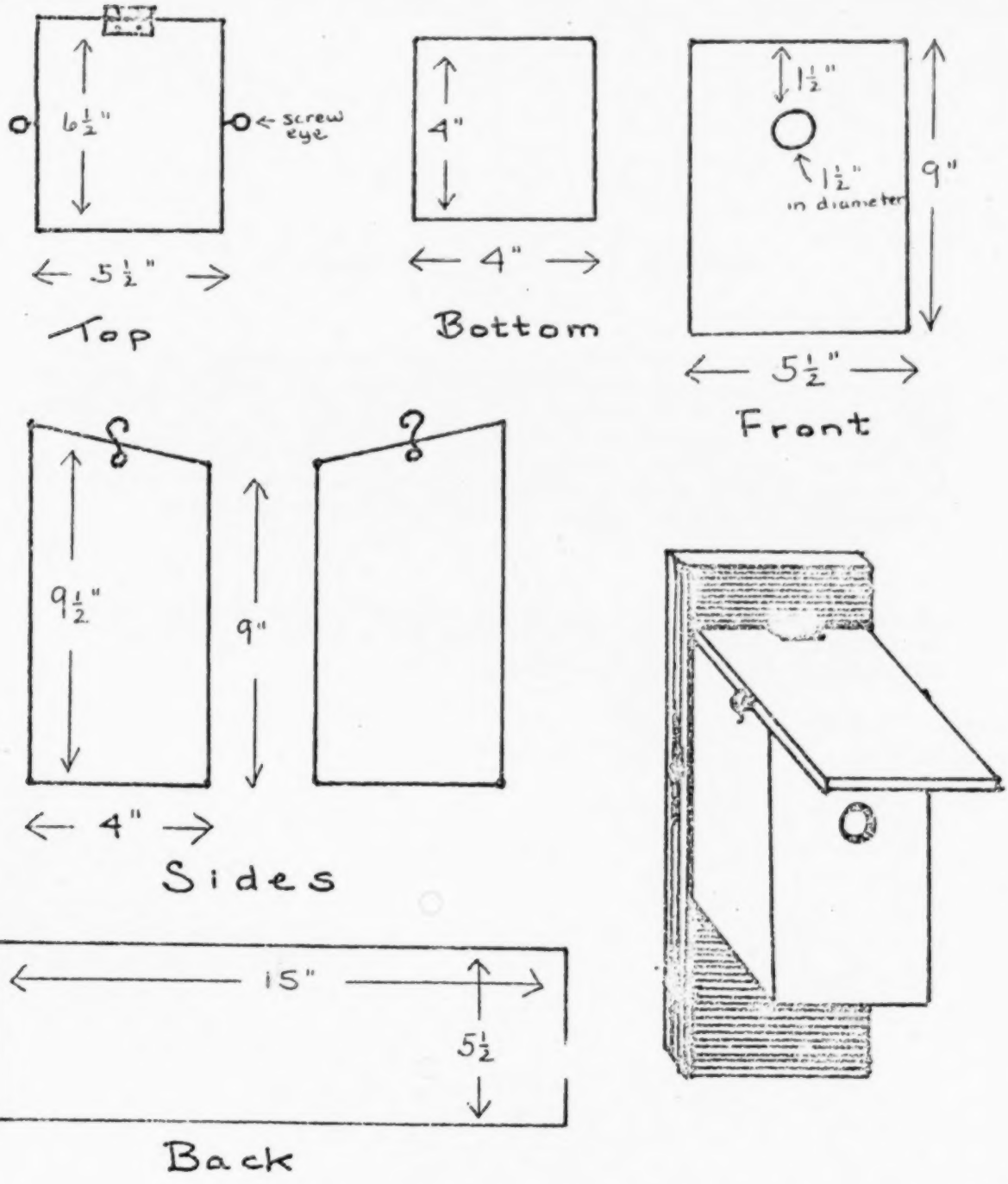
Follow-up #12

Plans for a Bluebird House

Be sure to follow measurements exactly.



Wood should be ¾" – 1" thick, with no cracks. Use 1½" long screws, not nails. Paint outsides and edges with brown or grey wood stain. A hinged top allows you to clean it out at the end of the season. (You may also hinge the bottom.)

Nail to a tree trunk or fence post 6-10" above ground, and facing an open space. The box should be shaded during the hot part of the day.

From All About Birds by Robert Lemon

FOLLOW-UP # 15 "Spore Printing" *

This is a very different kind of printing. Spread a thick coat of half-mucilage-half-water mixture (or slightly beaten egg white) onto a piece of thin cardboard. Cut off the stem of a mature, fully-opened mushroom directly under the cap. Place the cap, bottom down, in the middle of the cardboard. Cover the layout with a turned-over dish, and leave undisturbed for 24 hours. Take the dish off and air dry.

* Copied from A Leader's Guide to Nature-Oriented Activities by Betty Van Der Smissen and Oswald H. Goering, Iowa State University Press, Ames, Iowa, p. 60.

FOLLOW-UP # 16 "Soil Contents" *

The higher the organic content, the better the soil. On the spot where you want to investigate the contents of the soil, trim off all the above ground vegetation down to the soil surface with a pair of grass clippers. Then dig out 1/4 cubic foot of soil by making a hole 8 1/2" square and 6" deep.

Spread out the soil in heavy wrapping paper or newspaper, a small amount at a time, and carefully separate the parts of it into the following groupings: Organic Matter - decaying leaves, stalks, roots, seeds; Animal Life - worms, grubs, insects, spiders, other; Mineral Matter - large pebbles, small pebbles, finer particles.

By using sieves of various mesh - 1/2", 1/4", 1/8", 1/16" — you can separate soil particles into even more exactly measurable parts. If you like, you can place the components of a soil sample in a number of screw-top jars to make possible a comparison with the contents of samples taken from other localities.

*Copied from Field Book of Nature Activities by William Hillcourt, G.P. Putnam's Sons, New York, 1950, 1961, p. 373.

FOLLOW-UP #17 Growing Microscopic Organisms

EQUIPMENT NEEDED:

petri dishes	pressure cooker
distilled water	mason jars
*agar	aluminum foil
graduated cylinder	soil

You can find out something about unseen organisms in the soil with the following experiment.

Following the directions on the bottle of agar, prepare the agar solution using distilled water. (About 300 ml. of water will provide enough to cover the bottoms of 12 petri dishes.) After the agar has dissolved, pour it into a mason jar, cover the top loosely with aluminum foil, and pressure cook it and the petri dishes at 15 lbs. pressure for 15 minutes. While the agar is still warm, lay the petri dishes out on a flat surface, being sure to keep the lids on them. One at a time, lift the lid from the dish and pour in enough agar to cover the bottom of the dish.
Quickly replace the cover.
Allow time for the agar to solidify.

Inoculate the plates with sprinklings of soil.

Incubate the petri dishes under various conditions (room temperature vs. refrigeration, light vs. darkness, etc.) for about 3 days. As a check on the sterilization technique used and for comparison with inoculated dishes, leave one petri dish uninoculated as a control plate with each group of petri dishes placed in different environments.

What are the colonies of growth you observe on the plates?
Where did these come from?
What may be their role in making soil?
At what temperatures and under what conditions are they most active?

*Powdered agar is obtainable in bottled form from biological supply houses.

FOLLOW-UP #18 Decomposers in a Terrarium

In the classroom or at home: (Note: Most of these are long-term projects.)

Find examples of decomposition in the school yard and at home. (Can you find any in the classroom?) Does decomposition continue if the object is brought into the classroom? What factors hasten decomposition?

Set up a "fungarium". How many different kinds of fungi can you succeed in raising? On what materials will they grow?

Set up a terrarium with "Betsy beetles" (also known as patent leather beetles, horn bugs or peg bugs). Spread the floor of the terrarium with a sprinkling of charcoal, sand, pebbles and potting soil. Lay loosely a large quantity of rotting wood on top of this. "Betsy beetles" may be found in most rotting logs. Keep the terrarium just moist enough to maintain some moss or a fern, but not wet enough for mold to grow. Keep top covered with glass or plastic, and shield the top and sides from direct light. What do the beetles eat? How do they feed their young? What sound do they make, and how? Can you discover why? What does their home look like? Are they harmful or beneficial insects? What is their place in the forest?

What is a compost pile? If your family does not have one, perhaps your parents will help you get one started. What reasons could you give them for having one?

What decomposers are there that you can't see? Sprinkle particles of decaying wood on the surface of the agar in several sterile agar plates. One plate should contain only agar to act as a "control". Keep the plates in a warm (72° F.) dark place for several days. What do you see on the plates? (Directions for preparing agar are in Follow-Up Activity #17.)

FOLLOW-UP # 19 "Jacks and Apples"

Some of the following statements are true of mayapples.
Some are true of Jack-in-the-pulpit plants.
Some are true of both.
Some may be true of neither.

Put M before those true of mayapples
Put J before those true of Jack-in-the-pulpit.
Put M&J before those true of both.
Put O before those true of neither.

_____ Male and female flowers are found on different plants.

_____ Green, cream and brown stripes are often seen on this.

_____ The leaf is umbrella-shaped.

_____ This plant is found in wooded areas.

_____ The fruit forms before the leaves appear.

_____ The leaves are slightly saw-toothed along the margins (edges).

_____ The flower is found under the leaves.

_____ The flower usually is found in a leaf axil.

_____ This plant has sometimes been called Indian turnip.

_____ This is the flower which blooms in May.

_____ The leaves are in a group of three.

_____ Orange spots are sometimes found on these leaves.

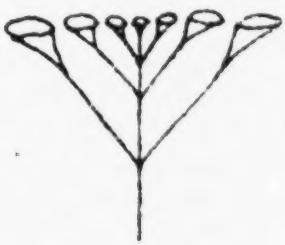
_____ Leaves may be divided into 2 to 9 leaflets.

_____ This is a native American plant.

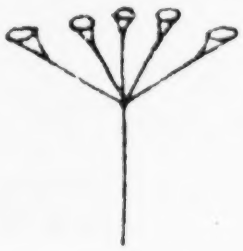
_____ The "flower" is really a leaf.

How many of these types can you find?
Which types are most numerous?
Use the blank spaces to sketch in other arrangements you find.

raceme



corymb



umbel

spike

spadix

composite

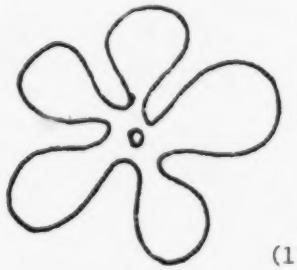
opposite - axillary

alternate - axillary

flower scape

terminal bud

leaf above flower



radial symmetry

bilateral symmetry

Corolla "recurved"

FOLLOW-UP # 21 Beware the Poison in the Backyard

House Plants

Plant	Toxic Part	Symptoms
Hyacinth Narcissus Daffodil	Bulbs	Nausea, vomiting, diarrhea. May be fatal.
Oleander	Leaves, Branches	Extremely poisonous. Affects the heart, produces severe digestive upset and has caused death.
Poinsettia	Leaves	Fatal. One leaf can kill a child.
Dieffenbachia (Dumb cane) Elephant ear	All parts	Intense burning and irritation of the mouth and tongue. Death can occur if base of the tongue swells enough to block the air passage of the throat.
Rosary pea Castor bean	Seeds	Fatal. A single rosary pea seed has caused death. One or two castor bean seeds are near the lethal dose for adults.
Mistletoe	Berries	Fatal. Both children and adults have died from eating the berries.

Flower Garden Plants

Larkspur	Young plant, seeds	Digestive upset, nervous excitement, depression. May be fatal.
Monkshood	Fleshy roots	Digestive upset and nervous excitement.
Autumn crocus Star-of-Bethlehem	Bulbs	Vomiting and nervous excitement.
Lily-of-the-Valley	Leaves, Flowers	Irregular heartbeat and pulse, usually accompanied by digestive upset and mental confusion.
Iris	Underground stems	Severe, but not usually serious, digestive upset.

Foxglove	Leaves	One of the sources of the drug digitalis, used to stimulate the heart. In large amounts, the active principles cause dangerously irregular heartbeat and pulse, usually digestive upset and mental confusion. May be fatal.
Bleeding heart (Dutchman's breeches)	Foliage Roots	May be poisonous in large amounts. Has proved fatal to cattle.
	Vegetable Garden Plants	
Rhubarb	Leaf blade	Fatal. Large amounts of raw or cooked leaves can cause convulsions or coma, followed rapidly by death.
	Ornamental Plants	
Daphne	Berries	Fatal. A few berries can kill a child.
Wisteria	Seeds, Pods	Mild to severe digestive upset. Many children are poisoned by this plant.
Golden chain	Bean-like capsules in which the seeds are suspended	Severe poisoning. Excitement, staggering, convulsions and coma. May be fatal.
Laurels Rhododendron Azaleas	All parts	Fatal. Produces nausea and vomiting, depression, difficult breathing, prostration and coma.
Jessamine	Berries	Fatal. Digestive disturbance and nervous symptoms.
Lantana camara (red sage)	Green berries	Fatal. Affects lungs, kidneys, heart and nervous system. Grows in the southern U.S. and in moderate climates.
Yew	Berries, Foliage	Fatal. Foliage more toxic than berries. Death is usually sudden without warning symptoms.

Plants in Swamp or Moist Areas

Water hemlock	All parts	Fatal. Violent and painful convulsions. A number of people have died from hemlock.

Trees and Shrubs

Wild and cultivated cherries	twigs, foliage	Fatal. Contains a compound that releases cyanide when eaten. Gasping, excitement, and prostration are common symptoms that often appear within minutes.
Oaks	Foliage, Acorns	Affects kidneys gradually. Symptoms appear only after several days or weeks. Takes a large amount for poisoning. Children should not be allowed to chew on acorns.
Elderberry	Shoots, Leaves, Bark	Children have been poisoned by using pieces of the pithy stems for blowguns. Nausea and digestive upset.
Black locust	Bark Sprouts, Foliage	Children have suffered nausea, weakness and depression after chewing the bark and seeds.

Plants in Wooded Areas

Jack-in-the-pulpit	All parts, especially roots	Like dumb cane, contains small needle-like crystals of calcium oxalate that cause intense irritation and burning of the mouth and tongue.
Moonseed	Berries	Blue, purple color, resembling wild grapes. Contains a single seed. (True wild grapes contain several small seeds.) May be fatal.
Mayapple	Apple, Foliage, Roots	Contains at least 16 active toxic principles primarily in the roots. Children often eat the apple with no ill effects, but several apples may cause diarrhea.

Plants in Fields

Buttercups	All parts	Irritant juices may severely injure the digestive system.

Nightshade	All parts, especially the unripe berry.	Fatal. Intense digestive disturbances and nervous symptoms.
Poison hemlock	All parts	Fatal. Resembles a large wild carrot. Used in ancient Greece to kill condemned prisoners.
Jimson weed (thorn apple)	All parts	Abnormal thirst, distorted sight, delirium, incoherence and coma. Common cause of poisoning. Has proved fatal.

The Poison Information Center, 655-3389, is open 24 hours a day. Call it if a child, or any member of the family, exhibits signs of an accidental poisoning.

Poison ivy, poison oak and poison sumac are well advertised outdoor dangers; but growing around them, in woods, fields, backyards, and even in the home, are some 700 other species of plants known to cause death or illness.

Each year, according to the U.S. Public Health Service, about 1200 children chew or swallow these potentially poisonous plants. Many are made violently sick; some die. Yet in most cases the children's parents don't even know that the plants are dangerous. The basic reason for this is that many of these plants grow in millions of backyards.

This is emphasized by the chart on these pages taken from the Family Safety Magazine of the National Safety Council. This plant list reads somewhat like a garden catalog. There is the daffodil, the poinsettia, the larkspur, the iris, the lily-of-the-valley, and the foxglove. There is the wisteria, laurel, rhododendron and azalea. There are the cherry trees, cultivated and wild, the oaks, and the black locust. Each is a potential danger, especially to young children with their natural urge to taste the unknown.

A child may die from eating even one leaf of a poinsettia, or a few mistletoe berries. The berries of the yew will cause death if eaten and the foliage of this common ornamental tree is even more toxic. Death usually is sudden, without warning symptoms.

The National Safety Council points out that it's easy to be fooled by plants because one part may be edible, another poisonous. The twigs of cherry trees, on which any youngster might munch release cyanide. Peach tree leaves contain hydrocyanic acid, one of the most dangerous poisons known. Five children recently became ill after sipping "tea" brewed with peach leaves.

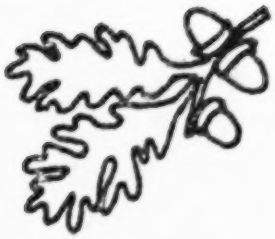
Rhubarb is another dangerous garden plant, but only in part. Its stalk, of course, is not toxic; but its leaves, which some have suggested could be eaten like spinach, can be fatal.

The plant variously called thorn apple, stinkweed, and jimson weed deserves a place on the top ten list of outdoor dangers. First, because it grows almost everywhere; second, because all its parts are poisonous. Responsible for more poisonings than any other plant, it grows from 2 to 5 feet tall and has large leaves and funnel-shaped flowers resembling morning glories.

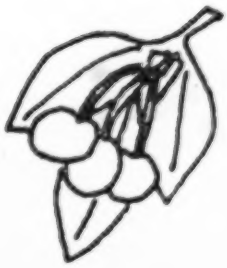
When 30 boys, ages six to eight, returned to a midwest orphanage after an outing, the effects of eating jimson weed were dramatically shown. Some of the youngsters barked like dogs; some crawled under beds to cry and moan. Others picked imaginary objects out of the air. A physician gave drugs and induced vomiting, and within three days all the boys were back to normal. The cause? The boys had found a patch of jimson weed and had eaten it in varying amounts. Other children, and even adults, have been less fortunate.

Best short, single safeguard: "Don't eat the daffodils or any other flower, leaf or berry -- unless you know it's safe."

Sources: "Poisonous Plants of the U.S. and Canada", by John W. Kingsbury; National Safety Council; U.S. Public Health Service; Bulletin of the New York Horticultural Society.



PRETTY, BUT POISONOUS!



HOUSE PLANTS

- HYACINTH (BULB)
- NARCISSUS (BULB)
- DAFFODIL (BULB)
- OLEANDER (LEAVES, BRANCHES)
- POINSETTIA (LEAVES)
- DIEFFENBACHIA
- ROSARY PEA (SEEDS)
- CASTOR BEAN (SEEDS)
- MISTLETOE (BERRIES)

GARDEN PLANTS

- LARKSPUR (YOUNG PLANT, SEEDS)
- MONKSHOOD (ROOTS)
- AUTUMN CROCUS (BULB)
- STAR-OF-BETHLEHEM "
- LILY-OF-THE-VALLEY (LEAVES, FLOWERS)
- IRIS (UNDERGROUND STEMS)
- FOXGLOVE (LEAVES)
- BLEEDING HEART (LEAF, ROOT)
- RHUBARB (LEAF)

ORNAMENTAL PLANTS

- DAPHNE (BERRIES)
- WISTERIA (SEEDS, PODS)
- GOLDEN CHAIN (SEEDS)
- LAUREL (ALL PARTS)
- RHODODENDRON "
- AZALEA "
- JESSAMINE (BERRIES)
- RED SAGE (GREEN BERRIES)
- YEW (BERRIES, LEAVES)

TREES, SHRUBS

- CHERRY (TWIGS, LEAVES)
- OAK (LEAVES, ACORNS)
- ELDERBERRY (LEAF, BARK)
- BLACK LOCUST (LEAF, BARK, SHOOT)

PLANTS IN WOODS AREA

- JACK-IN-THE-PULPIT (ALL PARTS)
- MOONSEED (BERRIES)
- MAYAPPLE (LEAVES, ROOTS)

FIELD PLANTS

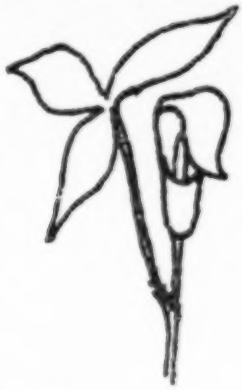
- BUTTERCUPS (ALL PARTS)
- NIGHTSHADE (ALL PARTS)
- POISON HEMLOCK (ALL PARTS)
- JIMSON WEED (ALL PARTS)

DON'T EAT THE PARTS NOTED!

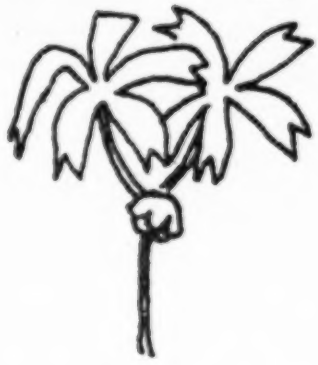
L. BERG

FOLLOW-UP #23 Name These Poisonous Plants

1. J



2. J

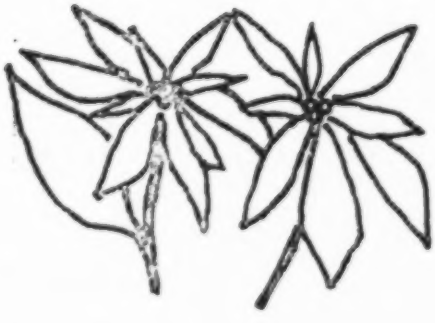


3. M

4. N

5. Y

6. F



7. P

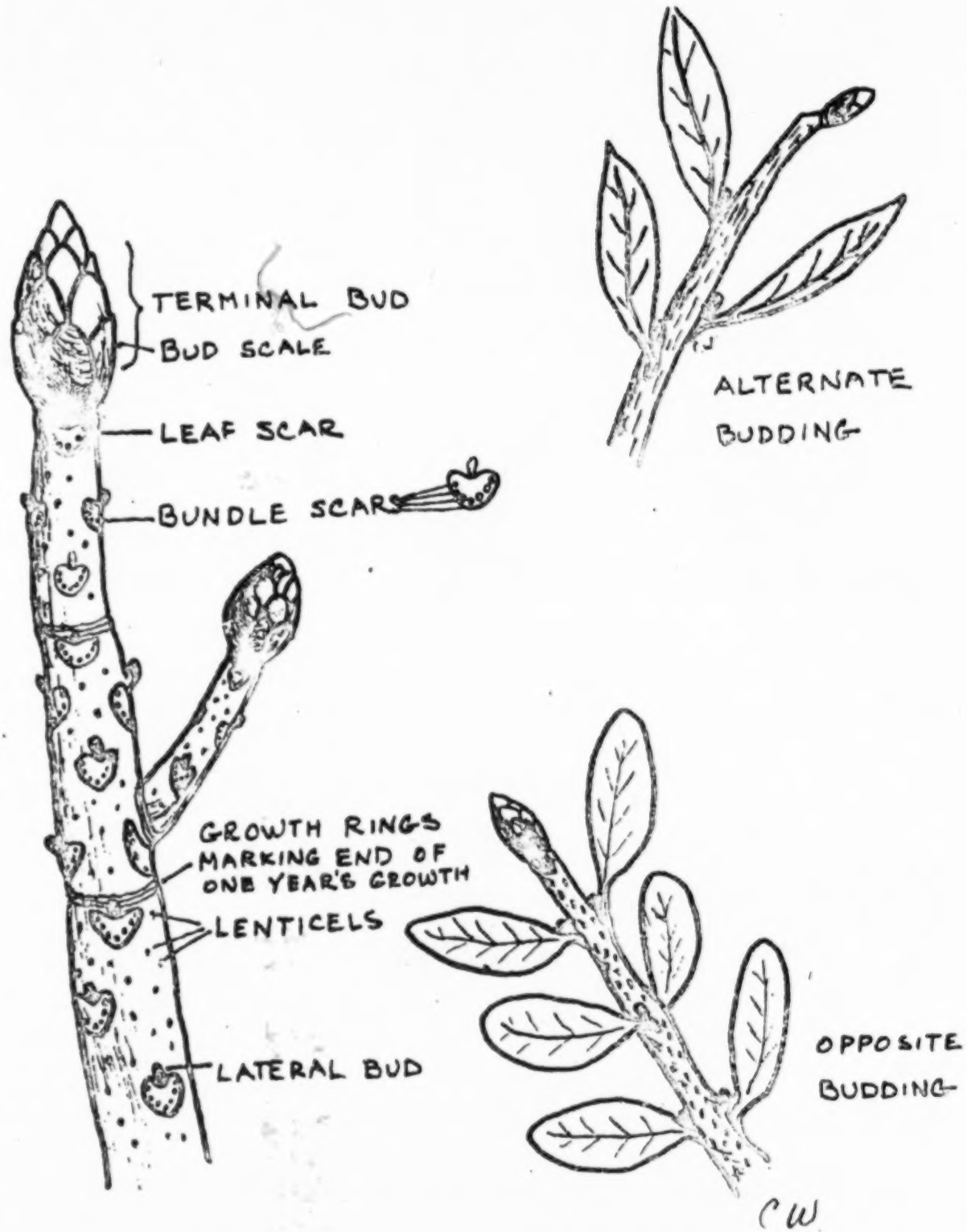
8. P H

9. L

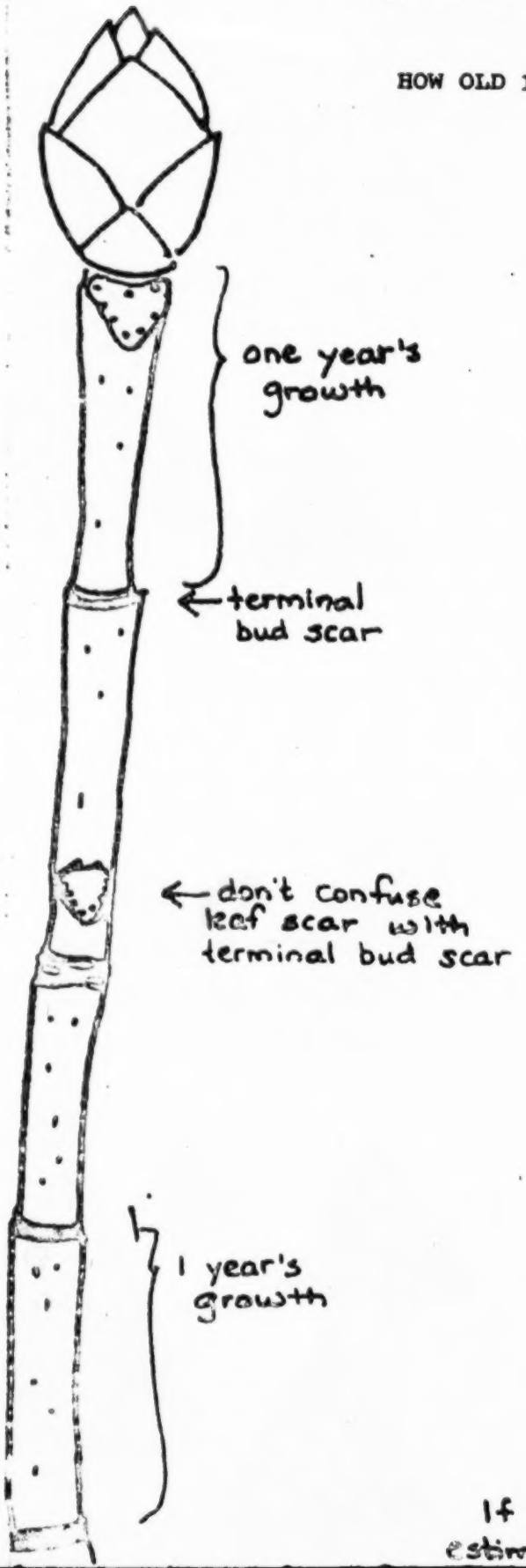
DO YOU KNOW THE NAMES OF THESE POISONOUS PLANTS? THE FIRST LETTER OF EACH IS GIVEN.

L. BERG

FOLLOW-UP #24 Buds



HOW OLD IS IT?



How old is this portion of this twig?

You can find the answer by counting the spaces between the terminal bud scars. (These are the "rings" that go all the way around a twig.)

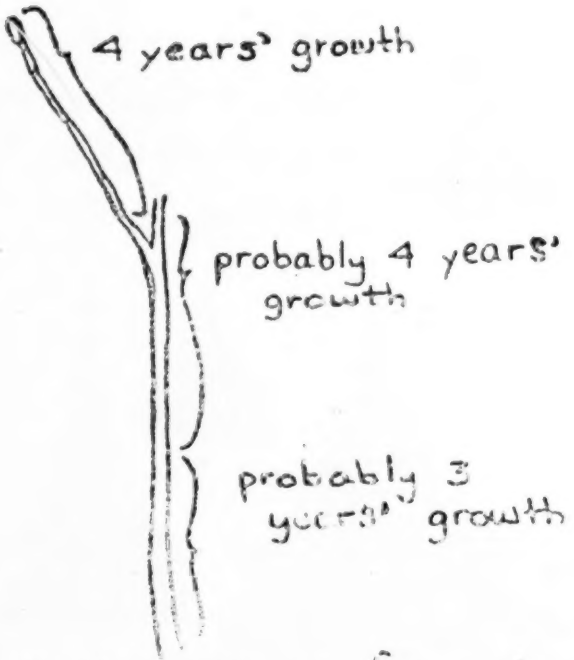
Can you find a sapling as old as you are and not as tall as you?

Younger than you but taller?

Exactly your age and exactly the same height?

Do all twigs on a tree grow the same amount each year?

What are some of the other marks on twigs besides terminal bud scars?

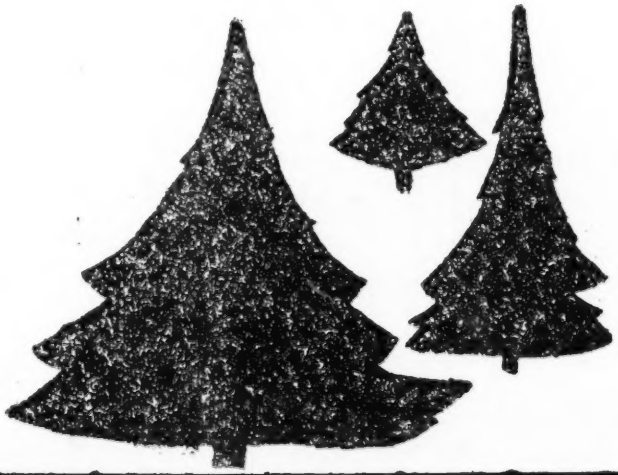


If a sapling's bark is furrowed, estimate age as noted above

What do you think: the little tree is ½ the size of the big tree? is ⅓ the size of the big tree? is ¼ the size of the big tree?

Is the small tree ½, ⅓, or ¼ as tall as the big tree?

Which tree is about twice the height of the tree to the left?



Which little tree is ⅓ the height of the big one?

FOLLOW-UP #29 Stories in Stumps

In the classroom:

How do scientists use tree rings for studies of past climatic conditions? Can you find any recently cut trees in your neighborhood which show signs of the 1962-66 drought?

How do scientists use tree rings for dating archeological finds? (You will need to know something about the above first. Clue topic: Mesa Verde.)

Are there annual rings in the cross section of a branch? a twig? Could you determine a tree's age if you had only a cross section of a branch?

How do scientists arrive at an estimate of the age of living trees, such as some of the famous giant sequoias? How do they know the bristlecone pines are the oldest trees in the world?

Use the tracings you made to construct a time line of events studied in history. (Question: Will it be necessary to have a set date for the year in which the tree was cut?)

What other stories can stumps tell?

Can you find the oldest stump in your neighborhood?

Can you determine the age of a tree that has fallen instead of being cut down?

What eventually will become of the stumps you saw during the field trip?

If you were to move away and not come back to this location until you were 70 years old, could you show your grandson the stumps you studied and let him count the annual rings? What did you see today that makes you think this?

Are tree stumps useful for anything other than studying growth and age patterns as we did? What did you see that makes you think this?

FOLLOW-UP #30 Neighborhood Trees

Are the trees in your neighborhood hardwoods or softwoods? Are they evergreen or deciduous? Which trees were planted? By whom: you, the township? Why were those kinds of trees chosen to be planted? How did the ones not planted by man get there?

Which ones were planted for shade, fruit, beauty, winter color, spring bloom, fall color, shape, screening, buds? What kinds of trees are suitable for planting near houses? along streets? Why? Which are not suitable? Why?

What kinds of trees are best for planting along city streets? Why? Investigate the particular problems each of these kinds of trees might cause if planted in the wrong place: willow, (female), gingko, chokecherry, honey locust, oak, maple, mimosa. (NOTE: Maple roots grow close to surface and may raise sidewalks. Maples also inhibit growth of lawn grass. Oaks may spread branches over roofs and cause damage if limbs break in a storm.)

What kinds of trees are best for climbing?

If the homes on your street were built entirely of wood and it required 100 trees to build each home, how many trees were required to build the homes on your street? Are there enough trees on your street now to build one home? How many trees would you predict would be needed to build an entire town, say for 8,000 people?

How many trees would remain on your street if each person living there, young and old, were to cut one down? Are any people on your street damaging these trees in a way that might kill them?

How long do you think you could heat your home with firewood cut from the trees on your street if you burned, on the average, half a tree per day.
How long could all of your neighbors heat their homes burning the same amount?

Can you find the trees that would make the best firewood? the poorest? Find out the cost of firewood. How is it sold? by pound?) Are trees more valuable left standing, or cut and sold for firewood?
It has been estimated that a large tree adds $500 to $1,000 to the selling price of a home. Do you have any valuable trees? If not, what would be the best kind to plant? If you live in a housing development, try to find out the cost of the trees that have been planted in the area. Who paid for them, the builder or the home owners?
Do you think any of the lawns have been planted with too many trees? Are trees too close?

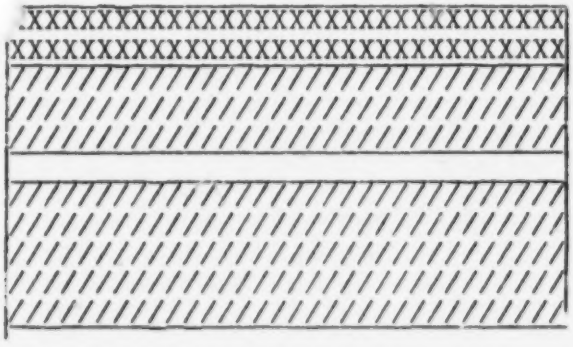
Try to sketch a picture of your house and its trees as it will look 10 - 20 - 50 years from now.

Are any trees in your neighborhood dying? Can you find out why? (Look for lawn mower injuries, insect injuries, storm damage, soil overfill.) What is the average life of paper birches, pin cherries, or choke cherries?

FOLLOW-UP #32 Earthworms

How do earthworms affect the soil?
Will earthworms live and thrive only in certain types of soil?

Set up an earthworm colony using something like an anthouse frame. Fill the frame with layers of soil, white sand, compost, and add charcoal to each layer to absorb odors. See diagram.



Be sure soil is compact enough that it won't settle when container is upright.
Place earthworms on the soil and let them work into it. (In a frame about 12 inches by 12 inches by 1", 10 is an average number.)
Fasten sides of frame together with tape.
Keep soil moist by adding a small amount of water every 4 days.
Keep frame covered with cardboard or dark paper. (Why?)
Make your first observations after about one week. Remove the paper from one side and observe immediately.

What do you notice about the line of sand?
What other observations can you make?

Observe again after another week.
Be sure to check condition of worms. You can try feeding them with small particles of vegetable matter or corn meal, but watch out for mold!

Further investigations can be made by measuring and weighing your worms at different times during your experiment. What changes in the worms do you observe if you replace the soil with fresh soil? Will the worms thrive in soil that is mostly sand? mostly clay? without humus? What happens if you get too much water in the frame? What outdoor observations can you make that have been suggested to you by the worms you have kept in the frame?

FOLLOW-UP # 33 Earthworms

Continued Observation

What is the response of earthworms to light and dark? to moisture? to temperature?
At what temperatures are they most active?
How do earthworms spend the winter?
How much do earthworms weigh? Weigh the largest, the smallest, a dozen "average" worms. What is the average weight?
Try to obtain an earthworm with an egg case. Time how long it is from when the case is deposited in the soil to when you see the first signs of baby worms.
Weigh a small worm. Compare the worm's weight with its length. What is the average weight per inch? (How does this compare with the weight per foot of the Australian giant which grows to 11 feet long and weighs 1 1/2 pounds?)

Weigh the container and soil you put him in. Weigh the amount of feed and water you add. How much weight does the worm gain in a month? Does the soil gain any weight? How does the gain in weight of the soil and of the earthworm compare to the amount of feed and water given? (Note: This experiment will be more accurate if done with a covered terrarium. Why?)

Research:

How are earthworms beneficial to man?
Are angleworms and night crawlers the same as earthworms?
Why are earthworms found on the sidewalk after a heavy rain? What happens to them? Why?
Which of these are related to earthworms? (Why or why not?)

- Flatworms
- Roundworms
- Nematodes
- Leeches

How many earthworms are in your yard? Take a census of a given area and estimate the entire yard's population. In what parts of your yard and/or garden are earthworms most numerous? Will earthworms live in indoor flower pots?

FOLLOW-UP #34 Insects at Home

Make an insect cage and observe insects, a few at a time, for several days.

Make up some problems based on crickets and temperature. Can your classmates solve them?

Observe insects in their natural surroundings in your yard, the school yard, and any other place you might find them.

Take a walk around your neighborhood at night. How many different insect sounds can you hear? If you take a flashlight with you, you may be able to track down one of the sounds and find the insect making it. (Watch out for the neighbor's flower bed!)

While insect-walking in your neighborhood, notice whether you hear more sounds as you pass a wide lawn, or as you approach shrubbery. Where would you expect to hear more sounds? Why?

If you can walk through or by a field, and through or by a woods, you can compare the insect sounds you hear in both places. You can also compare them with the ones you heard in your neighborhood. Would you expect to hear the same ones?

If you have a portable tape recorder, you can tape-record the insects you hear at night and play the recording at school. Perhaps your classmates would like to make up some imaginary insects that made the sounds. Of course, you'll want to make up names for them!

What is a "bug light"? Are insects attracted to certain color lights? Set up an experiment to find out. Be sure lights are the same wattage. Put a glass collecting jar with a funnel in it beneath each light.

At what times of day are insects most evident by sound? by sight? Atwhat temperatures are they most observably active?

At what time in the evening do you first begin to hear the insect chorus? Keep a record for several weeks. What factors seem to influence their activity?

What insects remain active latest in the fall? Can you set up a record sheet on which to record activity, temperature, and dates?

Where do the insects go in winter? Can you find examples of insects which migrate? hibernate? which survive only in the eggs of their young? Do any insects remain active in winter?

During late fall or winter investigate possible hibernation hide-aways. Take the temperature in likely locations, such as under logs, under the loose bark of trees, in crevices in the bark, behind shutters on your house. Where else? What do you find about these temperatures as compared to temperatures of the air?

Can you find out if male and female insects are colored differently? are of different sizes?

Questions for Research:

What insects spend part of their lives in the soil?

Do wasps gather honey?

How do insect wings differ from bird wings? Are airplanes patterned more after birds or insects?

How does an insect fly?

How does a firefly light? Does light, temperature, or some other factor influence the firefly's activity?

What other forms of life would be affected if we invented a chemical that killed all the insects?

FOLLOW-UP #35 Insect Calendar

On this calendar, keep a record of the insects you hear this fall. You can use a symbol or abbreviation for each, such as CR for cricket, K for katydid, M for mosquito, etc. Show daily temperature extremes.

FOLLOW-UP #36 Ant Farm

You can buy a plastic "ant farm" ant house, or make your own. (See Follow Up #37).
Early spring and fall are the best times to start an indoor colony. Be sure to collect the queen ant. (Why?) She is at least twice as large as the worker ants.
After locating an ant hill, lift the earth cover with a shovel and set it aside.

Transfer the ants and earth to a bucket.
Restore the nest as much as you can.

To transfer your ants from the bucket to the "ant farm", spread newspapers on a level surface.
Spread small quantities of earth onto the newspapers and transfer the ants from it to the ant house.
Don't overcrowd your nest: about 50 ants will be enough.

If the ants are too active for easy handling, you can refrigerate them for a while.
Keep the nest at 70-80°F.
Keep the soil moist.

Should you keep the ants in a well lighted place, or in the dark? Why? What happens when there are changes in temperature?

What kinds of soil do ants use in their nests?
What happens if you put different kinds of soil in the different sections of the nest?

Feeding:
Syrup or dissolved sugar in water will substitute for what natural foods?
Ants need protein! During the winter a good diet can be made from the following recipe:

> To a small amount of egg white, add the same amount of vegetable oil, the same amount of syrup, and twice the amount of water.
> Stir well.
> Store in refrigerator.

During spring, summer, and early fall, you may be able to make observations of what the ants of this colony ate at the home site.

Do you think ants are beneficial or harmful insects? Why?

FOLLOW-UP ACTIVITY #37

How to Set up an Ant Colony for Study

Get several wide-mouthed jars, with tops; a large sheet of white paper; bags or bucket for earth; spoons; trowel or spade.

After locating colony, work quickly. With spoons, scoop cocoons and larvae into one of the jars, workers and guards into another, and queens into another. Don't overlook the workers that return to the colony while you are digging! Beware of crowding - about 15 ants per jar is the limit.

Lay paper beside the colony, and scoop dirt onto it. Put some of the dirt into the bucket, and put some of it with 1 queen and some workers back into the colony site. Replace any stone or log moved.

Put leaves, grass, and damp earth into jars with the ants.

Collect any bugs, aphids, beetles, or other small insects found in the ant colony. Put them in another jar.

Have prepared indoors a large jar with a flat-bottomed rock that will fit into it. You will also need 2 small moistened sponges, a cheesecloth to cover the jar, and string or a rubber band to hold it in place. Using plaster of paris, construct straight-sided walls (smoothed so the ants can't climb them) around the edges of a large board (about 16 inches square).

Fill the large jar with earth from the colony up to about 2 inches from the top. Place rock on top of dirt, against one side, and put sponges inside. Place the large jar inside the plaster of paris walls.

Turn workers out into yard (inside walls) with cocoons, larvae and eggs. When they have found the earth inside the large jar, watch them build the new nest. By the next day put the remaining ants and bugs into the yard.

The earth in the jar must be kept moist but not wet. Keep the drinking sponges wet, and feed the ants regularly.

When you have finished your observations, return ants and earth to their original site.

THINGS TO OBSERVE

How long does it take an ant egg to hatch? How long does the ant spend in the larval and pupal forms?

How can you tell an ant egg from a cocoon?

FOLLOW-UP #38 Spiders

Observe a spider for a week or two. If several people in the class each observe a different kind of spider, interesting comparisons can be made.

How to Catch Spiders for Study

Take a glass jar with a lid. Put the jar behind a spider which is in its web and quickly bring the lid up from the front. If the spider is in a funnel-web, tease it out with a broom straw. Invert a glass jar over it, slide a piece of cardboard under the mouth of the jar, and turn the jar right side up, then cap it.

Crab spiders are often caught accidently when a bouquet is picked. Pick a bouquet, or gather a handful of dried leaves or grass. Place the flowers or leaves in a large white pan and look for the spiders to appear.

Glass jars make the best traps because once in the jar, the spider cannot move up the glass quickly enough to escape before you get the cover on it.

Keeping Spiders

1. Keep the spider in a wide-mouthed jar, covered with cloth or a fine wire screen. In the jar keep a moistened sponge, towel, or piece of cotton for humidity, and a stick or other debris for the spider to crawl on.
2. Cover the bottom of a large terrarium with moist soil and leaf mold. Do not add any extra water. With this kind of vivarium, enough air will circulate even with a glass lid. Be sure to keep the terrarium out of direct sunlight.
3. Construct a box with 2 opposite sides made of window glass, about a foot square. The other sides may be of wood. The width should be about 6 inches (i.e. between the sheets of glass). This box is particularly good for studying orb weavers.

Care of Spiders

Feed live flies or other insects. (Why should they be alive? What happens if you feed dead insects?)

NOTE: Spiders can go long periods without food. However, some people feel it is better to keep the spider temporarily, and then release it rather than to encourage children to kill one species to feed another.

Things to Look For

How does the spider eat? Does it eat all the insect? (Note: Most spiders suck the body fluids from their prey, thus leaving the discarded carcasses.)
Does the spider eat the insect immediately or preserve it for future use? (If so, how?)
How often does it eat?
When does it eat most readily? early morning? after dark?
When is the spider most active?
Keep a diary with notes on the life of your spider.

SPIDER TRACKS

Spread a large sheet of white paper on the floor or table.
Pour into a jar lid just enough black ink to cover the bottom.
Put the lid in the center of the paper.
Put your spider feet down into the ink and let it crawl onto the paper.
Examine the foot prints.
Did the spider run or jump?
In what order did its feet touch the paper?
Did it drag any part of its body?
How long is the space between steps? How does this compare with the size of the spider?
Repeat this with spiders of other species.
(You may get an interesting picture to frame and put on your wall, or the class could make a bulletin board with tracks of each kind of spider studied.)

OBSERVING SPIDERS IN THEIR NATURAL ENVIRONMENT

Look for spiders at night.
How do they react to the light of a flashlight?
Are the spiders in the garden more or less active than they are in the day? Is this what you would expect? Why or why not?
How do spiders over-winter? (Some wrap themselves in layers of their own silk. Even juveniles over-winter often in a cocoon-like web.)
In garages or basements, look for Theridion, a small spider which makes a web of a maze of unpatterned threads, and deposits in it a greyish brown pea-sized egg sac. Blow on the web through a drinking straw daily, until you see signs of hatched spiderlings. Estimate the number.

Keep watching and counting daily. Does the number of spiderlings decrease or remain the same? Why? Where would they go? Is there any other possible explanation for their disappearance? What do you suppose they are eating? What enemies do they have? Are spiders cannibalistic? (Letting such an egg sac hatch in a terrarium or glass jar would perhaps increase the accuracy of your census.)

Do you ever see more than 1 spider in a web? Do spiders seem to live in colonies, like ants and bees, or alone?

RESEARCH

Students check reference books for information about trap door spiders, wolf spiders, and others.
How are spiders beneficial to man? (An English naturalist, John Cromption, has estimated that spiders in England and Wales eat 22,000,000,000,000 insects annually.)

What is the story of Robert Bruce and the spider?
What are some Indian legends about spiders?
What is the Greek myth of Arachne? (Do you see any relation between this and the name"arachnids" applied to spiders?)

For Discussion

Why do you suppose many people fear spiders? Should they? Why or why not?
Could "Little Miss Muffet" have anything to do with this fear?

A WORD ABOUT POISONOUS SPIDERS

Two poisonous spiders occur in this region. One, the female black widow, is notoriously marked with the red "hourglass" on her underside. The other, the small brown Recluse spider, is not so well known, having but recently reached these latitudes from the southwest. Neither is common, and more likely found in old wood piles or long-accumulated piles of debris.

Most spiders, however, do have "poison" glands which are used to inject paralyzing fluids into their prey, in some cases thus preserving them alive to serve as meals for their yet-to-be-born offspring. A spider bite to a human is usually no more dangerous or annoying than a mosquito bite.

FOLLOW-UP #39 Spider Webs

The following instructions for collecting webs are taken from "The Web Weavers", (Boston, Beacon Press, 1964). Similar instructions can also be found in the "Golden Book of Nature Activities".

It is possible to collect webs if you are patient and work very carefully. First find a web, then some dark construction paper or cardboard large enough to cover the whole web. You will also need some white spray paint. Use this carefully, noticing which way the wind is blowing, so no one will get in the way of the paint. Be sure that there is nothing behind the web that the paint would harm. Spray the web carefully from a distance. Now place the paper back of the web without disturbing the web. Be sure that every strand of silk is touching the paper. Snip off any web around the edges and capture the web from its surroundings. There you will have the spider's work outlined for you in all its beauty on your sheet of paper. The wet paint will act as glue. When it is dry you may want to spray it with a plastic spray to preserve it, or cover it with Saran Wrap.

FOLLOW-UP #40 Spider Webs

How many different kinds of spider webs can you find? Do different kinds seem to be found in certain habitats? Do you ever find an orb web like that of the garden spider in your basement or garage? What kinds of webs do various spiders make? Do all spiders spin webs? Capture a variety of spiders in a series of glass jars. Be sure the jars are large enough to permit the spinning of a web. Be sure to put in the jar a stick or sticks as tall as the jar. Try to include crab spiders found on flowers, spiders found in your basement or garage, garden spiders, jumping spiders, and any other kinds you can capture.

You might want to try other types of spider cages. An example is to build a rectangular box one foot by one foot by six inches. Make the two facing sides of two pieces of window glass, one foot square. Put a small hinged door in the top or on one side.

Capture a garden spider or other orb weaver. (Do this by bringing a glass jar up behind the spider, then quickly capping the jar from the opposite side of the web.)

If you are successful in having the spiders spin webs in your spider cages, you can study the web by placing dark or light construction paper behind it, illuminating it from various angles. Try spraying it with water from an atomizer.

Drop an ant or fly (live) into the box. On which strands of the web does it get caught? Do these strands appear any different from the others?

Collecting Webs:

Find an orb web without the spider in it.
Spray it with a can of white enamel, held far enough away that large droplets do not collect on the strands.
Place a sheet of black construction paper behind the wet web.
With scissors snip the foundation lines.
Blow the web against the paper to make it flat.
When the paint is dry place the web in an acetate folder to preserve it. Compare web constructions of different spiders.

Are "cobwebs" spiderwebs?
NOTE: Look up "comb-footed" spiders.

Try to make a "spider web" with nylon or silk thread.
Be sure to read "Charlotte's Web" by E. B. White.
Why are spiders called Arachnids? Read the Greek myth Arachne.

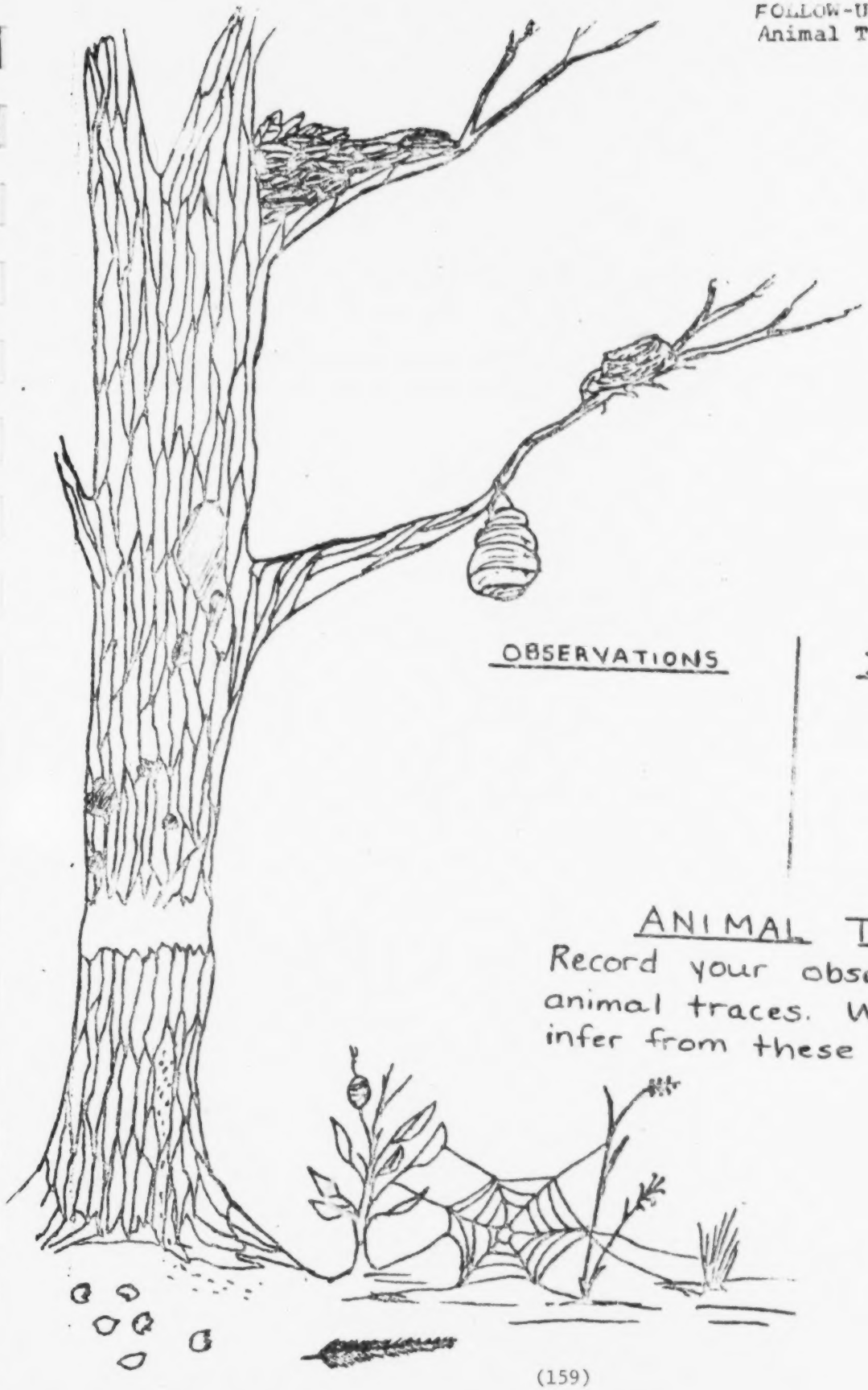
The following words are often used to describe spider webs.
What do they mean:

gossamer
orb
doily

Research:

How are spider webs used commercially?

FOLLOW-UP #42
Animal Traces



OBSERVATIONS | INFERENCES

ANIMAL TRACES

Record your observations of animal traces. What do you infer from these?

FOLLOW-UP # 43 Animals at Home

How many of these can you find around your neighborhood or school? Each time you find one, make a little note next to it telling where you found it.

1. Fungi nibbled
2. Mole tunnel
3. Sapsucker holes
4. Snail (or slug) silver track
5. Bark beetle tracings
6. Leaves eaten by caterpillars
7. Leaves cut by leaf-cutter bee
8. Deer tracks
9. Raccoon tracks
10. Rabbit tracks
11. Squirrel tracks
12. Pheasant tracks
13. Spider web
14. Spittle bug's foamy house
15. Oak apple gall
16. Aphid galls on leaves
17. Woodpecker holes
18. Owl pellets
19. Bird's egg shell
20. Bird's nest
21. Squirrel's nest
22. Worm trails in mud
23. Cocoon
24. Groundhog hole
25. Leaf miner's trail in a leaf

FOLLOW-UP #46 Spring Birds

Put O in front of anything you observed today.
Put R in front of anything you learned by reading.
Put H in front of anything you have heard someone say.
Put T in front of anything you think is true, but don't know where you learned it.
Put NT in front of anything you think is not true.
Put DK in front of anything you don't know.

_____ Birds sing in spring.

_____ Birds sing when on the ground.

_____ Birds sing from perches high in trees.

_____ There are more birds in the woods than in the field.

_____ Woodpeckers hammer on living trees as well as on dead ones.

_____ Robins eat worms.

_____ Some birds catch insects in the air.

_____ The male and female Baltimore oriole are not colored the same.

_____ An oven bird's nest looks like an oven.

_____ The male bird does more singing than the female.

_____ The female bird does all the work.

_____ All birds migrate.

_____ A bird with a thick heavy bill probably eats insects.

_____ Hawks can't see very well.

FOLLOW-UP #47 Birds in Habitats

What birds did you see in each of these places?

Field	Forest	Edge of Woods	Near Buildings

FOLLOW-UP # 48 Field Study of Birds

Arrange bird names in alphabetical order!

Field sparrow	Chickadee	Robin
Indigo Bunting	Woodpecker (Downy)	Starling
Cardinal	Vireo (red eyed)	Phoebe
Tufted Titmouse	Thrush (wood)	Grackle (Common)
Flicker	Wren (House)	Mockingbird
Song sparrow	Warbler (yellow)	Turkey Vulture
Redwinged blackbird	Bluejay	Mourning Dove
Cowbird	Crow	
	Catbird	

Where do you find these birds? List any others that you saw.

FIELD	WOODS	EDGE OF WOODS

FOLLOW-UP # 49 Bird Identification

"Bird Identification Game"

Take large pictures of common birds and cut a mask to cover each bird. Cut circles which will expose beak, feet, tails.

One day show beaks:	Who can guess the bird by seeing just its beak? What kind of food would this bird eat?
Another day show feet:	Where would you be most likely to see this bird? Are his feet good for grasping twigs or trunks of trees? Can you tell anything about the way he would move on the ground?
Another day show tails:	Does this bird hold its tail up, down, or out? Does the tail have distinctive colors?
Another day show entire bird:	Review the functions of various beaks, feet, and tails. Is there any relationship between the type of beak and the kinds of feet and tails birds have?

FOLLOW-UP #50 Bird Riddles

1. I am a letter of the alphabet, _____
2. I am a high official of a church, _____
3. I am very fast, especially near chimneys. _____
4. The man doing construction work uses me. _____
5. Although I am a symbol of happiness, people think of my color when they are sad. _____
6. You'll find me at a corner, spelled differently. _____
7. I must be a good baker because my nest looks like part of the kitchen. _____
8. I like to have a gay time. _____
9. I am just a "little feller". _____
10. You might need me on your baseball team. _____
11. I help get your food to your stomach. _____
12. I really don't chew my cud nor give milk. _____
13. I lost my hair. _____
14. They say I have fur _____ woodpecker _____
15. I'm a thief! I was caught in the act of _____.

FOLLOW-UP # 51 Bird Diets
(Math Word Problems)

That Hungry Bird!

(1) If 1/8 of a redwing's food is the farmer's grain and the rest of its diet is weed seeds and insects, what fraction of his diet is weed seeds and insects?_____

(2) If the redwing's diet is seeds and insects, and seeds make up 75%, what percentage is insects?_____

(3) If 40% of a barn swallow's diet is flies, what part of his diet is other insects?
_____

(4) Normally grasshoppers make up 25% of a meadowlark's diet. In August, they may be 75% of his daily food supply. If a meadowlark eats 4 grasshoppers and 12 other insects per hour in June, how many grasshoppers may he eat per hour in August?_____

(5) A pair of flickers was eating ants. The male ate 5000 and the female 3000. How many more ants did the male eat than the female?
_____

(6) Two scarlet tanagers ate 2000 gypsy moth caterpillars. This was an average of how many per bird?
_____

(7) If one yellow-billed cuckoo ate 250 tent caterpillars in one day, how many tent caterpillars could 4 cuckoos eat in one day?
_____

(8) Three nighthawks ate 60 grasshoppers, 500 mosquitoes, and 1000 ants. How many insects did they eat altogether?_____

(9) If a housewren feeds 500 spiders & caterpillars to its young in 1 afternoon, how many will it feed them in one week of afternoons?
_____

(10) A swallow ate 1000 leafhoppers in 12 hours. This was an average of how many per hour?_____

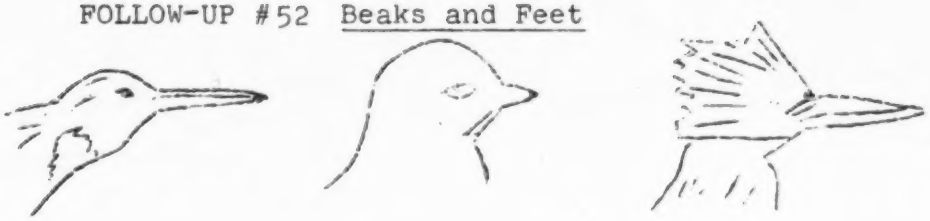
(11) If a Baltimore Oriole ate 17 caterpillars in a minute, how many could he eat in 5 minutes?_____

(12) If a brown thrasher can eat 6180 insects in one day, this is an average of how many an hour?

Facts from Garden Club of America
Conservation Committee

FOLLOW-UP #52 Beaks and Feet

Bird Bills



_____ _____ _____

_____ _____ _____

_____ _____ _____ _____

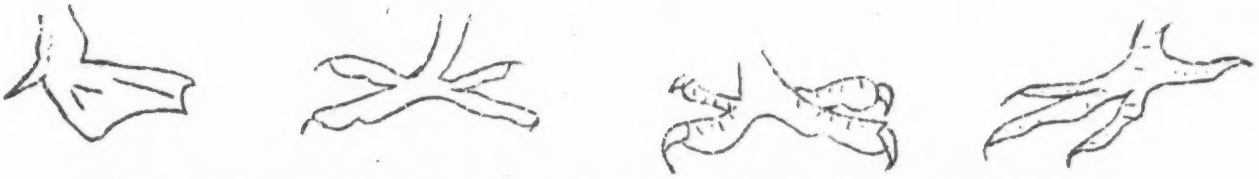
_____ _____ _____ _____

Write the name of the bird and the food habit on the lines below each bird head.

Name of birds: Cardinal, Kingfisher, Hummingbird, Hawk, Woodpecker, Swallow, Duck

Food habits: Drills for insects, sips nectar, spears fish, cracks seeds, tears flesh, catches insects, sieves plants from water.

Bird Feet



Write what each foot is used for and the name of the bird. Choose from this list:

Use:	Birds:
Swimming	Sparrow
Perching	Duck
Catching live prey	Hawk
Hanging onto tree trunks	Woodpecker

From MY WEEKLY READER, Science Notebook Supplement, Issue 2, Ed.5, 9/15-19, 1958

FOLLOW-UP # 03

MARSH OR
STREAM ORGANISMS

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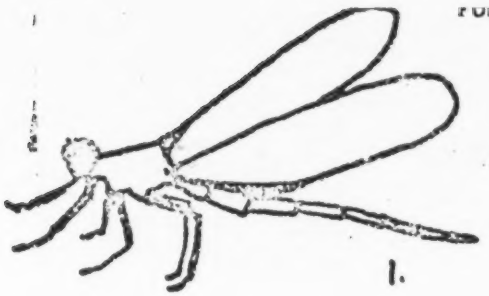

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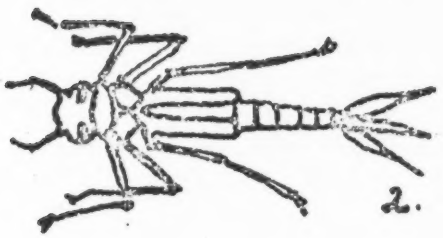

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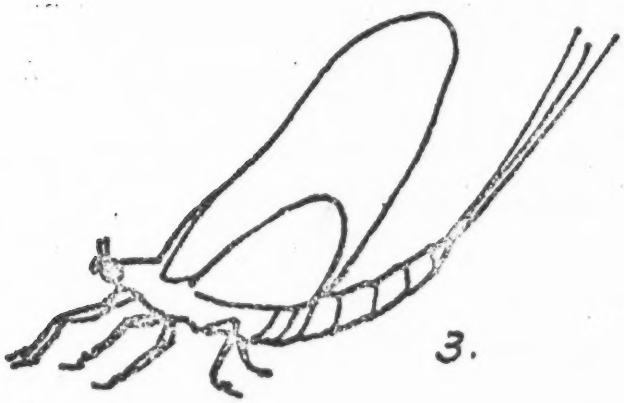

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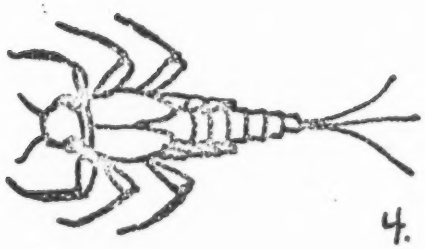

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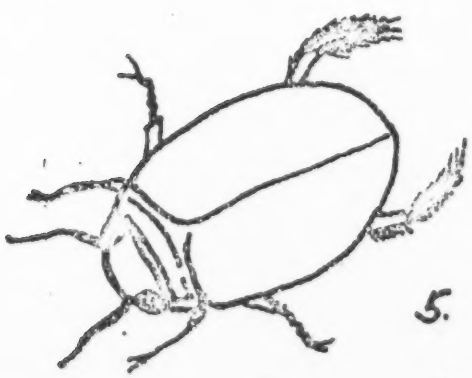

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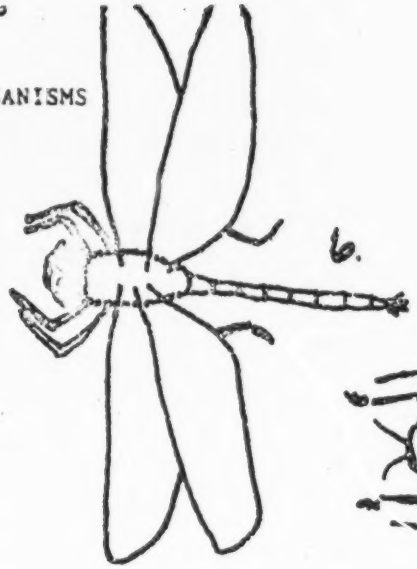

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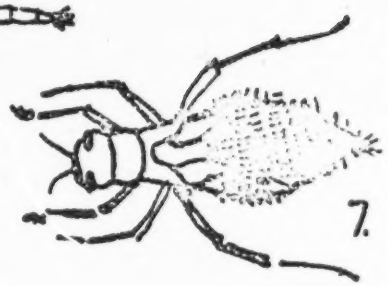

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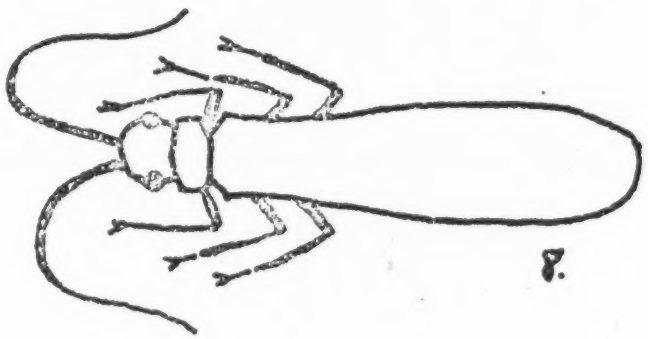

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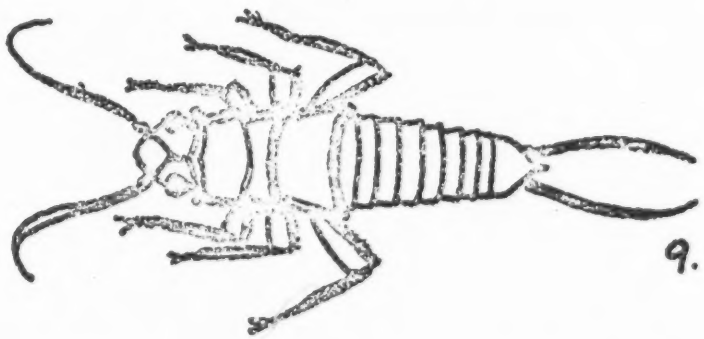

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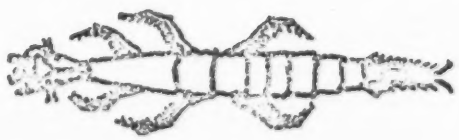

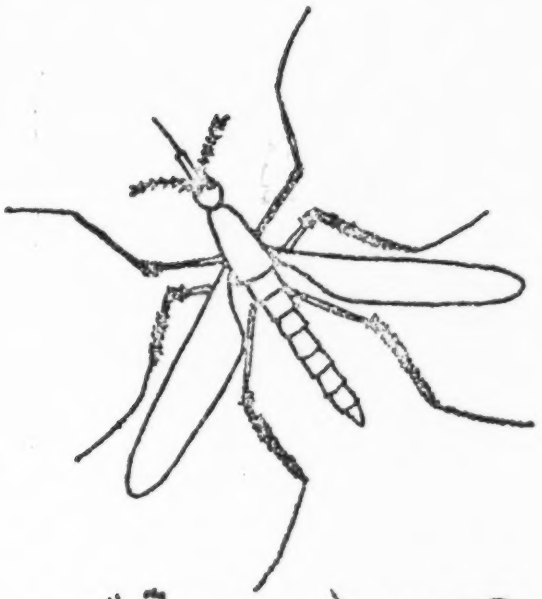

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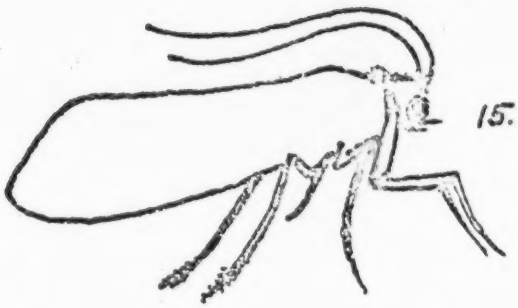

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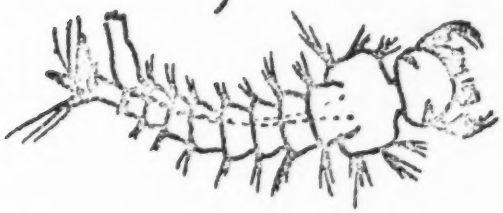

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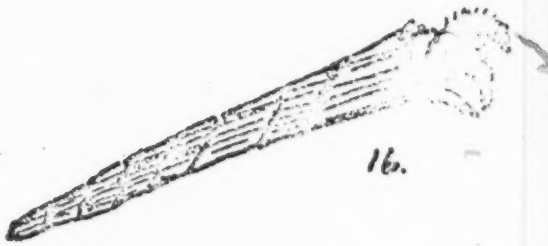

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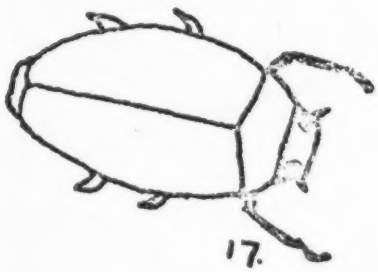

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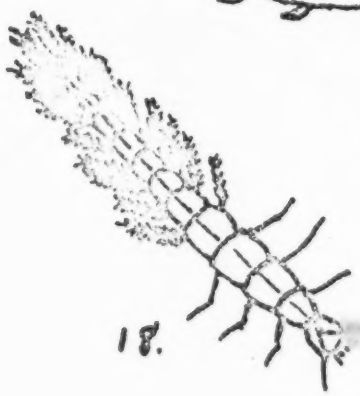

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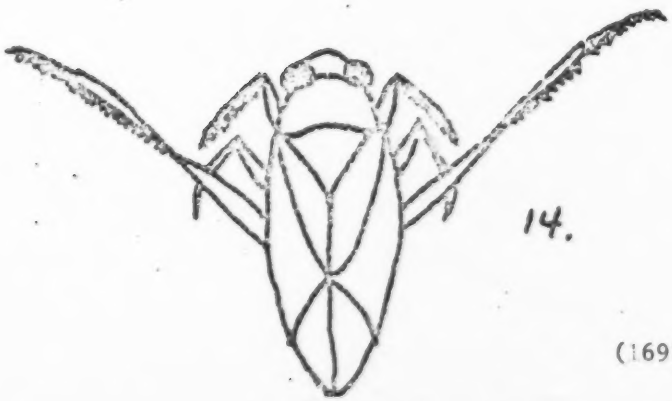

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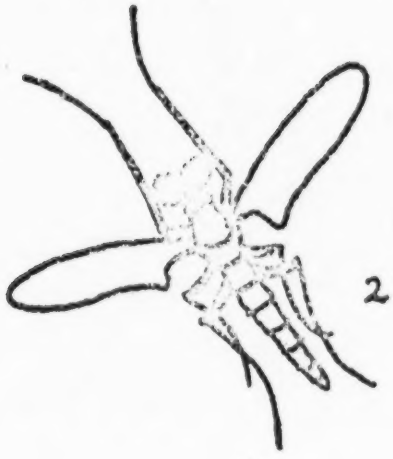

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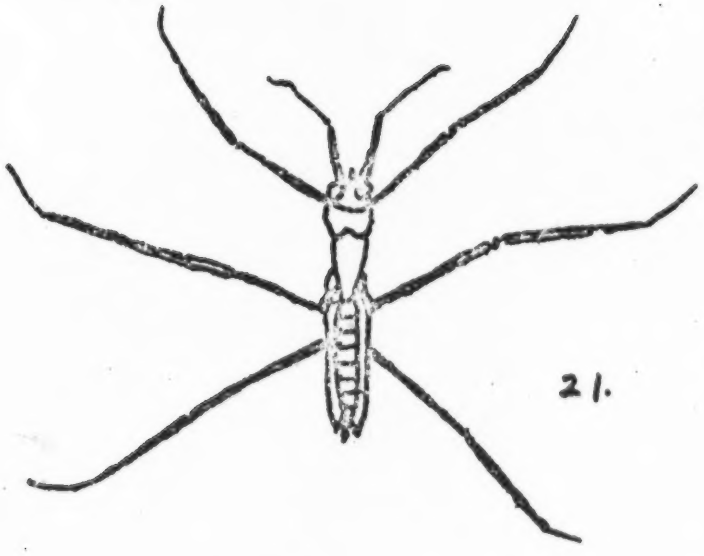

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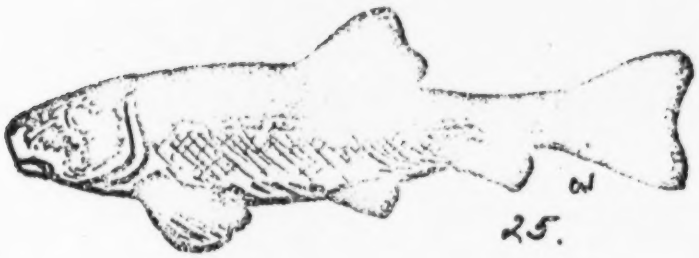

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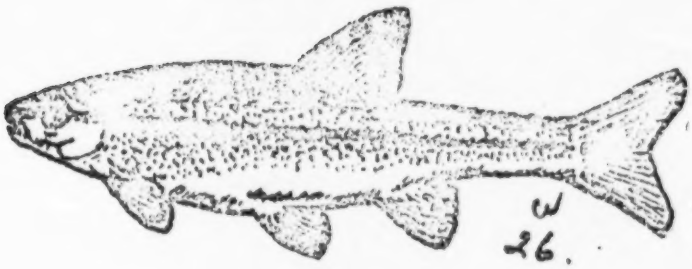

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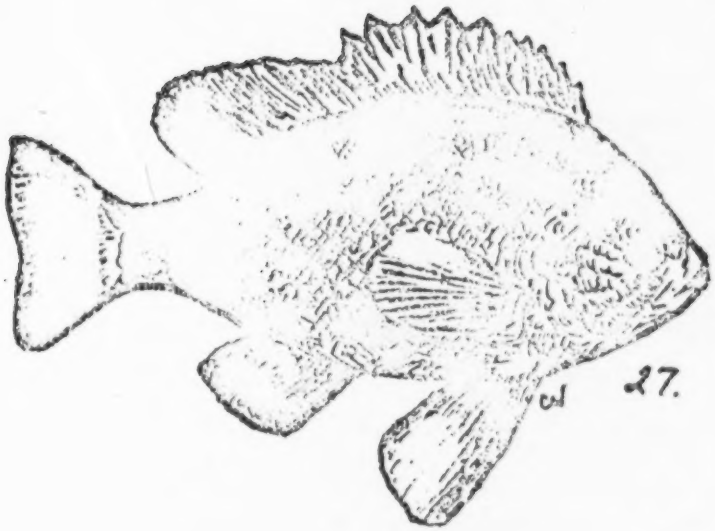

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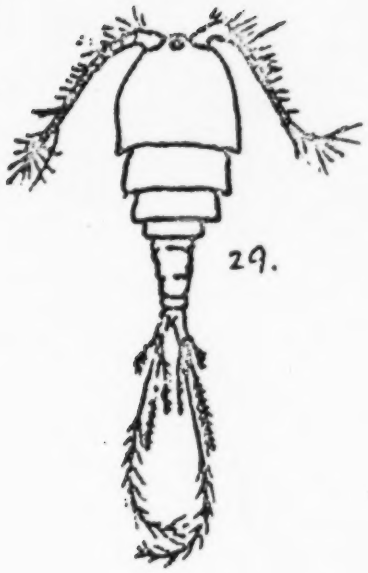

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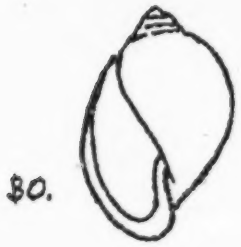

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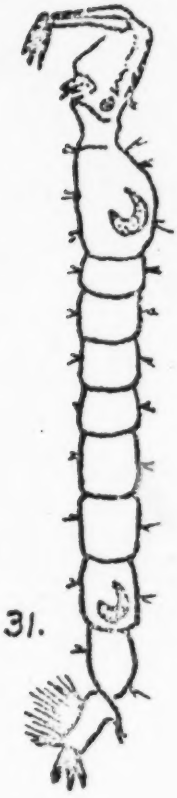

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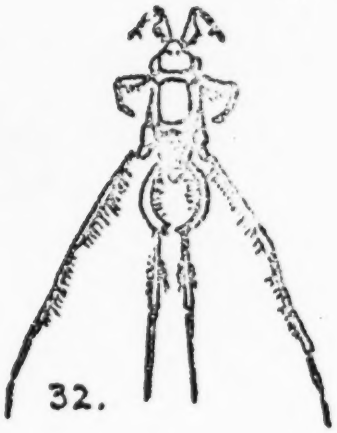

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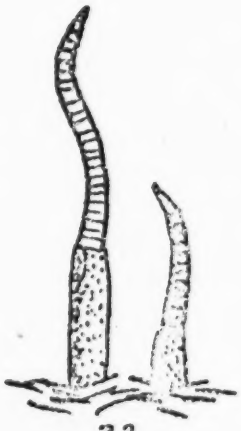

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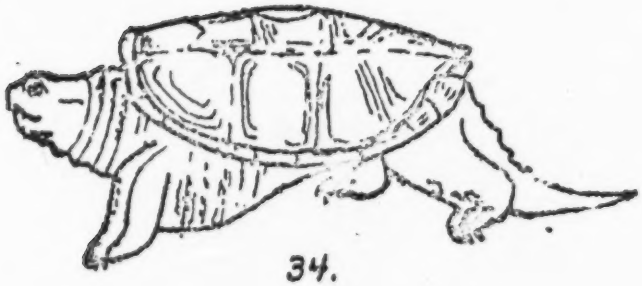

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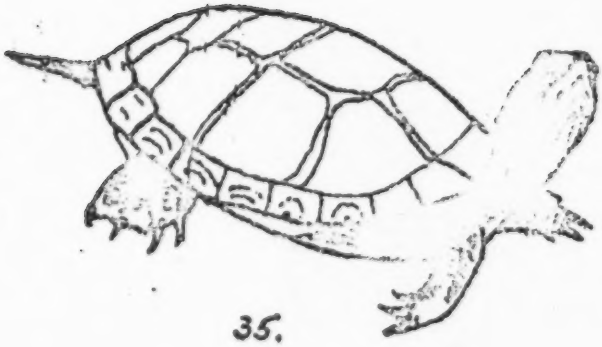

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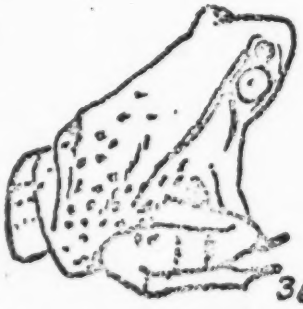


36.

37.

POND LIFE

1. Damsel fly
2. Damsel fly larva
3. May fly
4. May fly larva
5. Diving beetle
6. Dragon fly
7. Dragon fly larva
8. Stone fly
9. Stone fly larva
10. Diving beetle larva
11. Mosquito
12. Mosquito larva
13. Mosquito pupa
14. Backswimmer
15. Caddis fly
16. Caddis fly larva
17. Whirligig beetle
18. Whirligig beetle larva
19. Water Boatman
20. Midge larva
21. Water strider
22. Tadpole
23. Midge
24. Giant water bug
25. Sucker
26. Black-nosed dace
27. Sunfish
28. Johnny Darter
29. Water flea
30. Snail
31. Phantom midge larva
32. Rheumatobates rileyi
33. Tubifex worms
34. Snapping turtle
35. Eastern painted turtle
36. Green frog
37. Pickerel frog

FOLLOW-UP # 54 Habitats

Below is a list of organisms usually found in these habitats. One of them is not usually found there. Which one is it? Explain your choice! Is there always one "right" answer or are there good arguments for several?

A Pond

fish, water lily, maple leaf, water strider, frog, bank swallow, tadpole, goldfish, back swimmer, grasshopper, dragonfly, mosquito

A Field

grasshopper, ash saplings, meadow lark, blackberry bush, grass, earthworms, pheasants, corn, sparrow, woodpecker, meadow lark, mockingbird, black snake, mouse, tractor, turtle.

A Woods

tree, boy, squirrel, dead log, beech tree, spice bush, wood aster, apple tree, mayapple, dead squirrel, spider, owl, chickadee, woodpecker, meadow lark, honeysuckle, termites, dead leaves, crow, rabbit, dog, woodchuck, deer.

FOLLOW-UP #57 OBSERVATIONS, INFERENCES:
Woods, Trees

	OBSERVATIONS	INFERENCES
1.	There are very few leaves on the trees.	The trees are dead.
	There are many yellow leaves and red leaves on the ground.	It is winter.
	The air is cold (47°F.)	It is fall and the leaves have fallen from these trees.
2.	The trees are arranged in long, straight rows.	The trees were planted by man.
	The trees all have the same shaped leaves.	This is an apple orchard.
	The bark and leaves of all of the trees look & feel the same.	These trees are all of the same variety.
3.	The stump is very crumbly, spongy, and soft.	The insects killed the tree.
	There are some insects and grubs on and in the stump.	The tree and stump are an old beech tree.
	The soil around the stump is soft and tiny plants are growing in this	The stump has been decomposing for more than two months. (A few months)

Each set of three observations may be matched with an inference or inferences. Select what you consider the best (better) for each set of observations. Draw a line from each set to the inference (s) of your choice.

FOLLOW-UP # 58 Surface Tension

Fill a glass tumbler to the top. Drop by drop, continue adding water to the tumbler until the water "mounds". Drop one drop of detergent into the tumbler. What happens? Can you explain why?

Take a bowl of water and a dry steel needle. Float a piece of paper, such as paper toweling, on the surface of the water, then lay the needle on the paper. Wait for the paper to sink. (Why does it?) What happens to the needle?

(NOTE: If you have a steady hand and a pair of tweezers, you can try laying the needle directly on the water surface. Be sure not to let one end of the needle touch the water first.)

Now, add a drop of detergent. What happens to the needle? Why?

Will soap cause the same reaction as detergent? What other substances affect surface tension? What is the relationship between the effect of detergents on surface tension and the use of detergents as cleansers? If detergents are discharged into a stream, what will be their effects on the animal life of the stream? What is the difference between non-degradable and biodegradable detergent? How quickly are biodegradable detergents broken down? Can you set up some experiments which will give you first-hand data on this?

Try submerging various materials, such as velvet or the leaves of different plants (especially jewel weed,or if this is not available, try the common "weed", lamb's quarters). What do you notice? How might this be related to surface tension?

FOLLOW-UP #62 Marsh Food Chain

In the classroom:

On paper make three columns labeled Producers, Primary Consumers, and Secondary Consumers. List the plants and animals you saw during the field trip in the appropriate columns.

Make a bulletin board food chain. If each of your classmates draws several animals or plants seen at the pond, you can connect them with arrows to show what eats what.

Investigate food chains in your back yard, in the school yard, in a wooded area near you, in a corner lot, on a farm.

Set up a "hay infusion" for classroom study. Place a small handful of timothy hay in a large agate or pyrex saucepan, about 3/4 full of water (do not use metal). Bring to a slow boil and cook for 1/2 hour. Cool. Pour into aquarium or wide mouthed jars. When a scum begins to form on the top "inoculate" the infusion with a small quantity of water from a pond, marsh, or some other outdoor aquatic habitat. Be sure to include some debris: rotting leaves or twigs, mud from bottom. Replace the water that evaporates with distilled water. Keep aquarium cool and lighted, but avoid long periods of exposure to direct sunlight. An occasional pinch of powdered milk may be added if needed to provide food for bacteria.

An alternate study would be a jar of duckweed with snails. Keep this covered and in direct sunlight.

These provide a constantly changing population of microscopic organisms for study. Topics for investigation could include:

Why does the population of paramecia, etc. increase and then drop?
What will happen if we introduce many more snails? remove the snails? add goldfish?

What happens when oil is spread on the surface of a pond to kill mosquitoes? Experiment with a drop of oil on one of the hay infusions. What organisms besides the mosquito larvae would eventually be affected? Why?

What happens when an insecticide is used? Which has more widespread effects, the insecticide or the oil? What are the advantages and disadvantages of both?

84f

FOLLOW-UP # 63 Pond Data Sheets

Water Temp:
Date:

PLANT LIFE

	Description	Color	Size	Sketch	Name	Other Notes
1.						
2.						
3.						
4.						
5.						
6.						

Water Temp:
Date:

85f

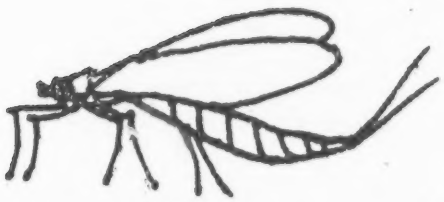
FOLLOW-UP # 63 Continued

INSECTS, AMPHIBIANS, OTHER POND LIFE

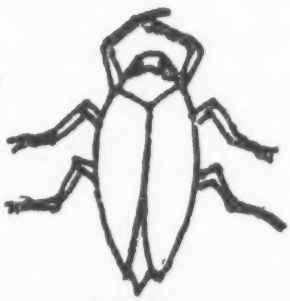
Size	Color	No. of Legs	No. of Wings	Sketch	Name	What does it eat?	Other Notes

FOLLOW-UP #64 Marsh Herbivores

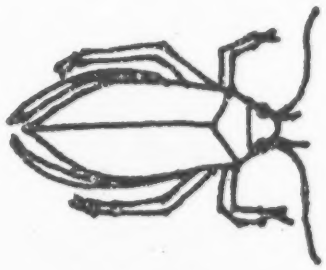
PUT AN "X" NEXT TO EACH OF THE AQUATIC ORGANISMS THAT IS AN HERBIVORE.



MAYFLY

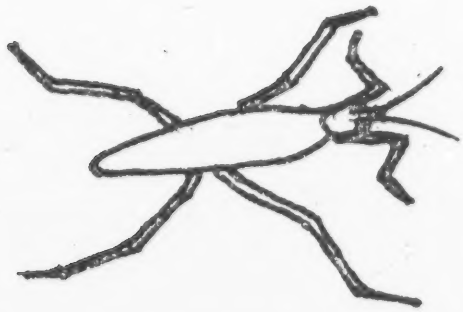


WHIRLIGIG BEETLE



DIVING BEETLE

FROG



WATER STRIDER

C. OCHS

FOLLOW-UP #65 Pond Succession

If the entire class cannot visit other pond (or marsh) environments, encourage individual students to do so and compare on-site observations with those made during their pond study.

Collect seeds of the types seen floating on the pond. Will they germinate in water? if planted in soil under water? in very wet soil?

What is the difference, if any, between a marsh, a swamp, and a bog? How would you interpret the past history of each of these areas? What would you predict for their futures?

FOLLOW-UP #66 Pond Water

Collect pond water in large jars. (Ask the school cafeteria for wide mouth gallon or two gallon jars). Take several samples from different areas, but don't specifically collect a lot of animals - just take some water, some of the "slime" present,some plants, if they are in abundance, and some of the bottom mud or dead leaves. Some jars could contain water from a mud puddle, a rain barrel, or any source of untreated water. Leaves or dry grass may be added to some jars. Chemically treated tap water should never be used because it kills organisms in the water.

These jars should be examined closely by the class, using hand lenses and microscopes as well as any other available means of observation. They should be carefully labeled as to the date and location of collection. Lids should be placed loosely on the tops so as to retard evaporation without shutting out oxygen, then the jars should be kept in convenient places, which also may vary. Direct sunlight, for instance, would encourage plant growth but decrease the growth of bacteria and hence the microorganisms feeding on them.

It might take a few observations of the water in the jars to see living things during first few days. After a week or two however, changes should be occurring at a comparatively rapid rate as the protozoa develop and the larger insect larvae or whatever you have die off. Protozoa are not easy to identify, and it is not really important to name them exactly. A descriptive name serves communication within the group and common ones may be identified using any of numerous books on the subject. You will probably find however, that no book encompasses the variety of life you will be able to find in your cultures.

The class should keep a notebook recording the changes observed and dates of the observations of each jar. Physical observations such as temperature and ph should also be recorded as well as the more obvious changes in odor, clarity of water, color etc. As the succession of organisms changes and a more stable condition developes, observations may lapse to one a month, but new and interesting changes have been seen in such cultures maintained without care for years. A challenge arises as to determining the reasons for each observed change in the jars.

FOLLOW-UP #68 Wind

Do buildings sway in the wind? Do flagpoles? Do electric and telephone poles? What would happen to a tall, rigid object that did not sway? Can you design an experiment to demonstrate this?

Investigate the construction of the Empire State Building. How can a building with a steel framework be flexible?

Read Robert Frost's "The Birches".

Read R. L. Stevenson's "Windy Night".

FOLLOW-UP #69 Soil Composition

For the classroom and home

Collect soils from different places at the surface of the school yard, home yard, and any woodlots or fields in the neighborhood. If children go away over the week-end, encourage them to bring back soil samples, especially from the shore and mountains. (Subsoils may also be collected.) Some of the activities which can be carried on with these samples are as follows:

A. Sieve a sample of each. What is left in the sieve? Did more soil go through the sieve or stay in it? Why? Put sieved samples in containers, separating sieved and unsieved portions, and keep for comparison with Activity B.

B. Take an equal quantity of each original soil sample.
Heat each of these in an oven until dry (or in a pan over a hot plate).
Weigh each sample. Record dry weight.
Put each sample (dried) in a glass bottle or test tube.
Add an equal quantity of water to each. Observe (time) how quickly the water disappears into the soil.
Pour in more water, measuring the quantity, until each tube is filled to the brim. Did each take the same amount?
Let stand 5 minutes.
Remove and measure the excess water from each sample. (It may be necessary to remove this excess water with a pipette.)
Which soil absorbed the most water? the least?
Weigh each sample and record wet weight. Compare with dry weight. Let stand 5 days. Weigh again. Compare the weights. What do you think accounts for the difference in weight loss? From which soil type did water evaporate most rapidly? most slowly? Sieve each of these soil samples. Compare the results with the sieving results from Activity A. What might account for the differences?

C. Put a sample of each original soil type in a test tube or bottle of water.
Describe what you see happening.
Cork the bottles and shake each.
Let the bottles stand, and watch the soil settle. Observe at intervals of 15 minutes. Record results. How long is it before the water in each tube is completely clear? Which soil type settled most quickly? Which took the

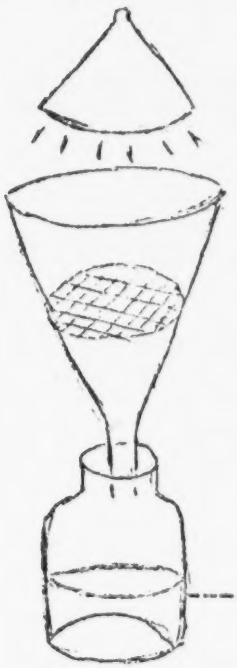
longest to settle? Why do you think this is so?

D. Combine several different types of soil: sand, gravel, silt, clay, loam. Add water to just-more-than cover. Shake. Observe the settling action. After 24 hours observe sediment layers, and draw what you see. How do these layers relate to the time of sedimentation recorded in Activity C?

Make the very best soil you can from natural materials. (Play fair! Don't add commercial potting soils from home!) Write your recipe. Try growing seeds in your soil. Have a class contest. Whose soil do seeds find best? (Be sure to keep other factors equal!) Grow some of the same type seeds in the other soil samples. Which do you think will grow best? Why? Compare the growth.

Are there things in soil you didn't see?
Take several sterile agar-plated petri dishes. (See Follow-Up # 17 for directions.)
Pulverize a bit of soil and sprinkle it over the surface of the agar.
Cover, keep dark.
Observe after several days. What do you see now?
Sterilize some of the same soil types by heating in an oven.
Transfer some of the sterilized soil (Be sure to use a sterile tool!) to other agar plates. Cover, keep dark.
After 3 days, compare growths in the 2 sets of plates.
What do you think the marks in the first dishes are?
Why didn't they grow in the second lot of dishes?
What soil type grew the most bacteria? Why might this be?

FOLLOW-UP # 70 Berlese Funnel



Many more insects and related organisms are found in soil or humus than can be seen even by close examination. Using the Berlese Funnel is a technique for the removal of these living things from the soil. A funnel can be made of construction paper or cardboard lined with aluminum foil or any comparable material. Glass chemical funnels or metal funnels from the hardware store may be used. The funnel is held under a lamp by a ring stand, or other holding device, with its end in a jar containing water or water and alcohol.

If soil or leaf mold is placed on a square of screening in the funnel and the light is left on overnight or longer, the insects in the material will move to lower levels in the soil or leaf mold as it dries and eventually into the water or alcohol where they may be studied at leisure.

FOLLOW-UP #71 Soil Mathematics

1. If the Mississippi dumps 400,000,000 tons of earth into the Gulf of Mexico annually, how many tons have been dumped since Columbus landed?

2. The Mississippi dumps 400,000,000 tons of earth into the Gulf of Mexico annually. This is an average of how many tons a month? a day? a minute?

3. If the equivalent of a 20 acre farm empties from the Missouri River into the Mississippi River each minute, how many "farms" are lost in an hour? in a day? a week? a year?

4. If there are 50,000 earthworms in an acre of top soil, how many earthworms would be in your property if your family owns a quarter of an acre?

5. If there are 50,000 earthworms in an acre of top soil, how many earthworms would there be on a 20 acre farm?

6. If these earthworms can build a 3 inch layer of top soil in twenty years, this is an average of what fraction of an inch yearly?

7. If these earthworms can build a 3 inch layer of top soil in twenty years, how long would it take them to build a layer one foot deep?

8. If natural erosion takes 500 years to weather an inch of top soil from rock, how much faster can earthworms build an inch of top soil from subsoil?

FOLLOW-UP #72 Soil Mathematics (for the teacher)

A Demonstration

Take an apple to represent the earth. Quarter it. Discard 3/4. On the remaining 1/4 are all our farms, forests, mountains, lakes and metropolitan areas.

Only 1/32 of the 1/4 has soil for growing. It takes about 500-1000 years to make 1" of good growing soil.

The Mississippi River dumps 400 million tons of earth into the Gulf of Mexico annually.

Every minute enough soil for a 20 acre farm empties from the Missouri River into the Mississippi River.

An Investigation

Dig up 1/2 sq. foot of untrampled soil 4" deep. Carefully examine the contents of this soil. How many animals did you find? Multiply the number found by 2 to find out how many (at this rate) you would find if the hole had been 1 ft. square at the top. Multiply this by 43,560 to find out how many animals would be in the top 4" of an acre.

In an acre of top soil, there may be 50,000 earthworms. These can bring 18 tons of subsoil to the surface yearly, building a 3 inch layer of top soil in twenty years.

Facts from: Conservation Committee
Garden Club of America

FOLLOW-UP #73 Rocks and Minerals

Encourage students to begin a rock collection of small specimens. An egg carton is a good container. The lid of the box should contain information about each specimen. For example:

Specimen #1, Milky Quartz, Middletown

Bringing collections to school allows students to swap specimens with their classmates.

A good magazine for young people to subscribe to is Rocks and Minerals.

FOLLOW-UP #74 Using Your Senses

(Some of these may be used as pre-trip activities)

On the school bus:

Ride for a while with eyes closed. Can you tell if the bus turns a corner? How? Are you going uphill or downhill? What kind of country are you passing? Are there many other cars on the road? What do you hear, smell, feel that suggest the answers you have given?

Look for the things you never noticed before.

In the classroom:

Arrange a display of herbs, seasonings, and sachets made from plants.
From what parts of the plants were these made?

Read the story of Helen Keller.

A Braille alphabet can be obtained from the Pa. Working Home & Philadelphia Association for the Blind. Weekly Reader puts out an edition in Braille. (American Education Publications, Education Center, Columbus, Ohio, 43216.) Try making Braille labels for classroom objects.

Bring in a collection of things with distinctive odors and have the class try to decide on adjectives for them. Note whether or not it is easy to agree - should you all agree?

Try writing a poem or story which a certain smell or scent suggests.

Experiment with "touch spots" on your hands. (Mark off a square inch on the back of the hand. By applying the tip of a pencil point at various spots within that inch, children should make some discoveries about sensitivity.)

With what parts of your body do you feel most? Blindfold a classmate and touch different parts of his face, neck, arms, hands with various objects. When does he "feel" them most accurately?

How do we hear? What can you find out about sound and/or the ears?
Why can we smell?

Why can't you taste things when you have a cold? Investigate the relationship of taste and smell. What do molecules have to do with smell and taste?

Blindfold a classmate and apply small bits of various foods to his tongue. Be sure to include salt, sugar, something sour, something bitter. Put a bit at a time on the tip, back, sides, center of his tongue. Does he taste every taste all over his tongue? Try putting something on the roof of his mouth and on his cheek. Does he taste it?

Set up a "taste committee". Taste various foods and other items and decide on an adjective to describe each. Is it easy to agree?

Blindfold a classmate and ask him to walk straight ahead to the other end of the playground. Repeat this with several more persons. What happens? Can you find out why?

How are perfumes made? How can "synthetic" materials be used to make odors and flavors?

Read Hailstones & Halibut Bones. Can you add to it?

When are outdoor odors strongest? "Observe" in warm weather, cooler weather, dry spells, during and after a rain, early in the morning, at noon.

Cook some foods adding some herbs seen in the garden. Eat some that you have never tried before. Bring some into the class.

Try growing herbs in windowsill planters (or in an outdoor school garden or at home).

Investigate which herbs the Indians and pioneers used medicinally. (Write to Plimouth Plantation, Plymouth, Mass. for further information.)

Read Christina Rosetti's, "What is Pink?"

Make a class list of sounds and smells experienced and of descriptive words used for unusual textures.

Put an object in an opaque container. Have children discover what senses can be used to determine what it is. Have them try to find out what it is.

FOLLOW-UP #78 From the Window of the Bus

How many billboards do you see? Are billboards useful to the public? Should billboards be restricted?

Watch for housing developments. Were the trees left standing? Have new trees been planted?

Does a stream run beside the road (or under it)? Is the stream littered with trash? Has it flooded recently? (How do you know?) Is it dammed?

Do you pass any vacant lots? What are they used for? Are they for sale? If so, what may they be used for? What do you think they should be used for?

Has the highway been cut through a hill? Are the banks eroding? If not, why not? If so, what could be done to prevent this? Where else might the road have been placed? Why wasn't it?

Read Robert Frost's, "This saying goodbye to an orchard...."

FOLLOW-UP #79 On The Bus

Some outdoor-oriented activities which may be used on the bus trip to or from the study area are described below.

ALPHABET GAME

Divide the class into 2 teams.
Each team watches for nature objects beginning with consecutive letters of the alphabet, such as "apple tree, bluejay, creek..." Whichever team completes the alphabet first wins.

You may want to limit the subjects to the trip activity, such as birds, animals, but this will make it more difficult.

" I WENT TO THE ENVIRONMENTAL LABORATORY AND I SAW..."

Start the game by saying, "I went to the Environmental Laboratory and I saw a grasshopper."
Each child in turn repeats the beginning of the sentence and adds on another thing seen, as "I went to the Environmental Laboratory and I saw a grasshopper and a bluebird."
You may wish to make the list alphabetical.

" I SPIED"

Children may take turns describing something seen during their field trip. The child who guesses what is being described gets to describe the next object.
This may be done in team form.

WATCHING FOR POINTS

In advance, make a list of nature objects which may be seen from the bus. Give each a point value. Divide the class into two teams (one on each side of the bus, or where two children are sitting in a seat, they may compete). Points are given to the team sighting each object first.

In advance make up a list of various map symbols. Give each symbol a point value. As the bus passes landmarks which would be identified by symbols on the list, children check off the symbols. At the end of the trip the team (or individual) having the highest score wins. (Children should be prepared to tell where they saw a landmark if their scores are challenged.)

LISTS

Divide the class into teams. Give the captain of each team a pencil and paper. In a given period of time, let each team make a list of all the sounds heard, or all the birds seen, or all the describing words that could be used in writing about something seen, etc. The team having the longest list wins.

FOLLOW-UP #80 "Evergreen Feelings"

ON THE BUS

Use "Feelings of the Forest" hand-out sheet (Follow-Up #81.) Make class lists of the adjectives used to describe the things seen, heard, felt and experienced in the pine forest.

IN THE CLASSROOM

Draw a picture that expresses your feelings in the pine forest, Make it as imaginative as you wish.

Write a play that could take place in the pine forest.

Use the bark-pattern tracings you made to create designs. Use these designs to make book covers, book marks, etc.

Look for commercial products, textiles, wallpaper, etc., which use nature as a theme, or as a basis for the design.

Experiment to find whether various objects (things from the out-of-doors or man-made materials) reflect or transmit light.

What do the words translucent,opaque, transparent mean? Can you find examples to illustrate each?

Find pictures which express certain moods or feelings. Find pictures that make you feel a certain way: sad, excited, contented, etc. What about the picture makes you feel that way; color?line? What else?

How does a musician create a mood through music? Listen to various recordings. Do they make you feel sleepy? excited? gay? sad? wishful? What do they make you feel like doing?

Find poems which express moods. ("Velvet Shoes" by Elinor Wylie is a good starter selection.) Try writing your own poems about evergreens.

Investigate how businesses use color, texture, music to create moods to stimulate efficiency, buying, etc.

For the Teacher:

Begin a study of adjectives.
Before the trip, introduce the pupils to the picturesque speech section of Reader's Digest. Follow up with a classroom creative experience in picturesque speech.

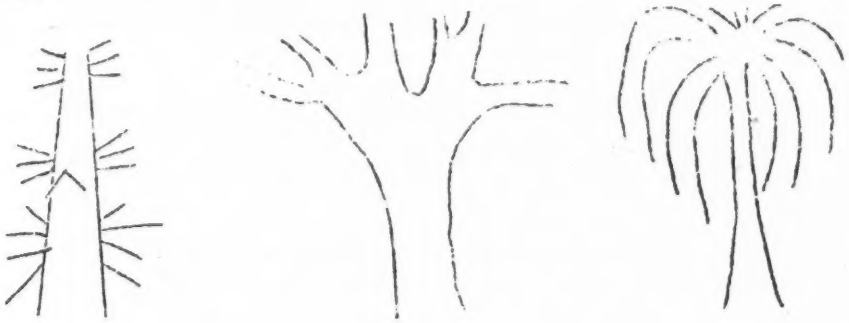
FOLLOW-UP # 81 Feelings in the Forest

You have just visited a pine forest!

Circle the answers you like best in these questions about it. (Your classmates may not agree with you. Could you tell them why you chose the answers you did?)

1. The pine tree "rows" were arranged like this:

2. Looking up at a pine tree in the plantation gave me this idea:



3. The pine forest made me think of the colors

   white black red grey blue green gold

4. In the pine forest I think I heard

   rustling leaves creaking wood many birds singing near me

   birds at a distance the wind in the branches

5. Walking through the pine forest was like walking on

   sawdust eggshells marbles the sidewalk a gravel road

6. In the pine forest, the time of day seemed to be

   going-to-school time noon late afternoon evening

7. In the pine forest I thought of
Fourth of July Easter Halloween Christmas Summer vacation Thanksgiving

8. In the pine forest I wanted to
run and shout walk quietly sit down and read a book lie down and take a nap go camping play hide and seek

9. The pine forest makes me think of such stories as
Hansel and Gretel Bambi Cinderella Black Beauty Snow White and the Seven Dwarfs Lassie Robin Hood

10. In the pine forest I would like to listen to the music of
a brass band a flute a piano drums a violin, an oboe

11. I would like to visit the pine forest again
in a storm alone at night on a hot summer afternoon after a snowstorm alone on a dark afternoon when a storm is coming while snow is falling never

12. I think if I visited the pine forest alone I might see
snakes deer bears spiders owls raccoons

13. I hope our class
comes back to the pine forest again goes to some other woods doesn't take another field trip

14. The best kind of field trip is one to
a museum a post office, bakery or other business place the out-of-doors a baseball or football game

FOLLOW-UP # 32

DROP COOKIES

1 cup butter
2 cups honey
2 eggs
1 3/4 cups flour
1 teaspoon soda
1 teaspoon baking powder
1/2 teaspoon salt
1 teaspoon cinnamon
2 cups rolled oats
1 cup raisins
1/2 cup chopped walnuts

If you were given 50 acres of bare soil, what would you have to plant and what animals would you have to raise before you could bake these cookies?